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EDITORIAL

The war and control of prices:— For some time past there has been an incessant demand from a section of the public for Government intervention on the matter of controlling the prices of commodities including food stuffs. While we are in sympathy with the just demands of the consumer in checking profiteering, there is one aspect of the question to which we wish to invite the attention of Government. Judging from the trend of prices prevailing at present, it is hardly right to suggest that there has been any profiteering on the sale of foodstuffs produced in India. Barring a temporary rise in the price of refined sugar, the price levels of the agricultural products have remained more or less stationary. On the other hand, the cultivator has today to pay enhanced rates for his prime necessities such as, clothing, implements, manures, pest and disease fighting devices, lighting, and building materials. It has also to be remembered that the cultivator has for several years laboured under the disadvantages of low prices, poor marketing facilities and in some specific cases from foreign competition. In the matter of exportable produce like wheat, oil seeds, cotton and plantation crops, higher freights and war risks have militated against his realising the full benefits of the slight advance of prices in the world's markets. The war has however just brought in a ray of hope and experience has shown that it will take several months before the benefits of increased prices trickle down to the actual cultivator. Any precipitate action towards price control will not in our opinion, be equitable and we trust that due consideration will be given to the interests of the silent tiller of the soil.

Fodder Crops in the Madras Presidency—A Revie

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Introduction. India has to maintain a dense population of over 200 per square mile, by methods of farming applicable only to tracts with about 2 persons to the square mile. The chief, and perhaps the only way to remedy the chronic under-nourishment of this dense population is by increasing the *per capita* consumption of milk and milk products. For this, a dove-tailing of arable and animal husbandries into one mixed-farming system is very urgently needed. As pointed out by Mr. Hilson in 1928, "the fodder problem in not only Madras, but the whole of India, is a very important and a very urgent one. Better fodder means better cattle and more manure of better quality ; this helps the farmer to raise better crops, get bigger profits and adopt a better standard of living as well as a higher level of mixed farming, with bigger and better fodder crops as an essential unit therein." The difficulty comes in, however, when one tries to formulate mixed-farming systems for all the widely varying conditions of climate and soils in India. For instance, in Sind and certain parts of the United Provinces, the introduction of irrigation into the existing dryland farming resulted in the deterioration of the excellent breeds of cattle that thrived there before. For efficient milk production, the nutritive ratio of the feed, i. e., the ratio between the digestible crude proteins and the combined digestible fats and carbohydrates, should not be wider than 1 : 10. Since, the usually available cereal straws, such as paddy, wheat and ragi, have only a nutritive ratio of 1 : 70 and even the better kinds of green fodders like sorghum and guinea grass

have a ratio of only 1 : 12, the need for including legumes like lucerne and sunnhemp with a ratio of 1 : 4, in the daily feed, would be obvious.

With regard to the fodder crops available, Benson wrote as far back as 1879 from Saidapet, "This country is pre-eminently favoured with forage crops that could, with ordinary farming skill, produce abundant fodder of first rate quality .....There is no reason why, for want of proper fodder, this country should not produce good livestock,instead of the miserable, degenerate animals that now serve for the cultivation of the fields as well as for transport on the roads" Thus, the urgent need for better mixed-farming methods, giving due prominence to forage crops is obvious; and good forage crops also are available. It would, therefore, be useful to review at this stage the past performance and the present position of all the fodder crops tried in this province so far.

Sorghum (Sorghum vulgare). Tamil—*Cholam*. Telugu—*Jonna*. To quote the words of Mr. Benson again, "This crop has scarcely any rival at all as a fodder crop." Being essentially a crop of semi-arid, sub-tropical regions, it is very tolerant to high temperatures as well as low moisture conditions, and is eminently suited to be the mainstay of fodder in regions of low to moderate rainfall. In fact, it needs less water per pound of dry matter produced than perhaps any other cereal crop, its average water requirement being 294 lb per pound of dry matter as against 309 for maize—its nearest rival, 388 for Sudan grass, 375 for teosinte, 470 for wheat and 600 to 900 for leguminous fodders like lucerne and cowpea. It is not however suited, even as a fodder crop, to tracts having long periods of heavy rainfall.

In South India, where 4,632 090 acres are under sorghum, the variety Periamanjal cholam, seems to be the most widely suitable type for fodder. The periods of sowing and of harvest in different parts of the Presidency are summarised below:—

A. **Rainfed** (91. 3% of total area) 1) Early crop; Sown in July—August, harvested by December--January. On the uplands of Vizagapatam and Godavari, and the districts of Bellary, North Arcot, Chittoor, Salem and Coimbatore. 2) Late crop; (a) *as a grain crop.* Sown—September—October, harvested by January—February. On the deltas of Godavari and Kistna and the districts of Guntur, Nellore, Kurnool, Bellary and Cuddapah; (b) *as a fodder crop.* The black soils of Madura, Ramnad and Tinnevelly.

B. **Irrigated.** (8. 7% of total area). Time of sowing not always definite, but usually sown in February and harvested by June. In the districts of Coimbatore, Madura, Tinnevelly, and to a lesser extent in Salem, Trichinopoly, Ramnad, Chittoor, North Arcot, Guntur and Anantapur. The yields of Sorghum in the different stations of the Presidency are given in the following table.

Average yield of Fodder Sorghum, in lb. per acre.

Agricultural Research Stations.	As straw from grain crop		As a pure fodder crop		Variety found most suitable	Remarks.
	Rainfed	Irrigated	Rainfed	Irrigated		
				(Green wt.)		
Berhampur				...		
Anakapalle				14,970		
Samalkota				...		
Maruteru				...		
Guntur			3,500		N 23/10	
Chintaladevi			3,400		*Pedda Jonna*	
Hagari	2,000			18,450		
Nandyal			3,590		N–29/82	
Palur				14,820	*Kaki Jonna*	
Tindivanam			5,430	21,830	*Periamanjal*	
Aduturai				14,530		
Pattukottai				15,930		
Central Farm, Coimbatore	3,150	6,460*		23,960	*Periamanjal*	* Chitrai cholam
Hosur	3,150			19,120	,,	
Gudiyattam				20,750	,,	
Taliparamba and Coconut Stations				10,410	*Periamanjal*	Maximum given. Yields very variable.
Pattambi			4,750		,,	
Koilpatti		5,500	3 540	19,100	*Irungu*	
Nanjanad (The Nilgiris)			Failure			

Sorghums in different tracts. (The Northern Circars.) Attempts were made at Berhampur in 1932 and 1933 to introduce sorghum as a fodder crop in the paddy fields during the off-season. This could be done only in fields that were sufficiently moist to be ploughed and sown, after the harvest of paddy by the end of December. Even in these fields, the peculiar tendency of the local clay-loams to cake up into hard pans, made one or two irrigations necessary, to help the crop during February and March. The outturn was 10,000 lb. the first year, but the 1933 trial was a failure. At Anakapalle, sorghum as a grain crop did not quite fit in with the local rotations, but for fodder it could be grown both as a rainfed crop in June giving an outturn of 9,000 lb. per acre, as well as under irrigation, after the harvest of summer ragi in April. The yields ranged in this case from 10,000 to 25,000 lb. per acre. No mention is made of any attempts with sorghum at either of the two deltaic stations, Samalkota and Maruteru.

In the Guntur tract, sorghum is the staple fodder both as a pure fodder crop sown in June and as straw from the October-sown grain crop. It was formerly usual for ryots here to reserve 5–6 acres for pasture, but with the increasing popularity of tobacco cultivation and the consequent rise in land values, they now tend to depend more and more on the upland taluks for

their fodder supply. On the Guntur farm the average yield for the rainfed crop works out to 3,500 lb. of dry fodder per acre. The best variety is found to be the Nandyal N. 23/10. Periamanjal cholam grows well enough, but is inferior in the quality of hay, besides being more liable to rust attack. Experiments to determine the optimum sowing time have shown that from June till the middle of July was the most suitable period. Manuring, with cattle manure as well as fertilizers like ammonium sulphate and superphosphate, was found both useful and economic, the nett profit over five years, working out to Rs. 13/- per acre. To improve the feeding value of the fodder, it was found best to grow sorghum mixed with *pillipesara* (Phaseolus trilobus, Ait) in the ratio of 3 : 1. Higher proportions of the legume tended to pull down the jonna yields.

In the carefully developed dry-farming system of the Ceded districts, sorghum forms a vital unit, the grain being consumed by men and the straw by cattle. The yields are on the average 3,600 lb. of straw per acre at Nandyal and 2,000 lb. at Hagari, although, wherever irrigation was feasible, (as at Hagari) the outturn goes up to 18, 450 lb. The variety N. 29/82 was the best at Nandyal, but at Hagari the Coimbatore variety Periamanjal has been found to come up very well as a fodder crop. A number of tests were carried out at both these stations to determine the optimum spacing between drill rows—but the wide seasonal fluctuations made most of the results inconclusive. At Nandyal, the local practice of 10½" between rows was found to be the best on the whole, although in years of poor rainfall, wider spacings of 16" to 28" were often preferable and closer spacings of 8" in good seasons. At Hagari too, the existing local practice of 18" spacing between rows was found to be the most profitable, although wider spacings (21—27") improved grain yields and close spacings increased the outturn of straw. Owing to the large areas of 40—50 acres, managed by a single pair of bullocks, farmyard manure is scarce and quite inadequate for any manuring of sorghum. Experiments indicate that applications of poudrette, ammonium sulphate, and super phosphate could be beneficial in favourable years. However, the low average rainfall (about 20" at Hagari and 28" at Nandyal) makes manuring rather a risky practice, because in droughty seasons, manured plants wither up much sooner than unmanured.

The Ongole breeding tract, with its 33" of rainfall, depends mainly on jonna straw for cattle feed. The yields on the Chintaladevi Farm (1918-1932) averaged about 3,400 lb. of dry fodder from the June-sown rain-fed crop. Here too, manuring was found uneconomic.

In the South Arcot alluvial tract round about Palur, formed by silt deposits from the two rivers Pennaiyar and Gadilam, wells are numerous and consequently the cholam yields too, are high, averaging 14,800 lb. of green fodder per acre. On the Palur Farm Periamanjal cholam has not done very well, the two best types being Kaki jonna from Madanapalle and Sen cholam from Polur. In years of favourable rainfall, it was often possible to raise a ratoon crop yielding up to 8,800 lb. of green fodder from the

June-sown crop of cholam. At Tindivanam too, cholam is the main fodder, and curiously enough, Periamanjal cholam, which did not stand very high at Palur, was the best at this station, giving an average yield of 5,430 lb. rainfed and 21,830 lb. under irrigation. In the Cauvery delta at Aduturai although paddy is the chief food crop and paddy straw the chief fodder, cholam could also be grown successfully, in Samba fields before paddy. The fields were kept ready ploughed and in June, as soon as water was received in the channels, Periamanjal cholam was sown and harvested by September giving an outturn of 14,500 lb. of green fodder in good time for transplanting the main Samba crop afterwards. It is not mentioned however, what the after-effect was, of such a cholam crop on the yield of the subsequent paddy crop.

Among the districts, Coimbatore stands first in the area under irrigated cholam having nearly 40% of the total of 135,000 acres in the presidency. In rainfed acreage it stands as the fifth. Periamanjal cholam is the dominant variety of the district, with an average yield of 3,150 lb. of straw from the rainfed crop and 23,960 lb. as irrigated green fodder. On the Central Farm, about 25 acres have been under sorghum every year, to meet the fodder requirements of a large dairy herd and about 40 pairs of work cattle. It has been grown here on quite a variety of soils, black soil dry lands, red soil dry lands, red soil garden lands, and even in the heavy wetland paddy soils. The cost of production in this last instance worked out very cheap being only 4 as. per 1,000 lb. of green fodder, as against Rs. 2/- in the garden lands. It was observed at the Central Farm, that the fodder yields of Periamanjal cholam, when sown between August and January were poorer than when sown from February to July, as the crop tended to rush to flower from September to January. Hence for these months, fodder maize was preferable, as it gave uniform yields all the year through, while from February till July, sorghum was better.

The sorghum crop, especially when sown thick for fodder, is notorious for pulling down the yields of crops that follow it. This has been traced to the activity of the dense network of cholam roots tending to make the soil somewhat alkaline, for about a year afterwards. Attempts were made at the Cotton Breeding Station, Coimbatore and at Koilpatti, to ameliorate this deleterious after-effect by mixing legumes like sunnhemp cowpea, pillipesara, cluster beans and lablab, along with sorghum, in various proportions, but none of them was very effective. However, a mixture of three parts of cholam with one of pulse, preferably cluster beans in the garden lands (at Coimbatore) and lablab (*D. lablab*) in the dryland black soils, was found to improve the feeding value of the mixed fodder, without affecting appreciably the sorghum outturn.

At the Millets Breeding Station, an exclusive fodder strain, A. S. 3355, characterised by very sweet and juicy stalks, with about 12% sucrose content, has been evolved from the Patcha jonnas of Nandyal.

It is well known that fodder crops are best cut soon after they flower, and sorghum is no exception to this. It is however dangerous to feed it before flowering, especially in cases where the crop after a vigorous start, got stunted through by subsequent adverse weather conditions. It then contains a cyanogenetic glucoside in quantities sufficient to prove fatal to animals. It has also been noted that a ratoon crop is usually more poisonous in the early stages than a similar stage of the original crop.

With regard to the feeding value of sorghum, certain preliminary experiments at Coimbatore indicate that the relative efficiency, i. e., the quantity of fodder consumed per pound of milk produced, is in the descending order, Guinea grass, fodder sorghum, and then fodder maize.

At the Central Cattle Farm at Hosur, about 30—40 acres are put under irrigated sorghum each year besides a large area of rainfed crop. The average yield is 3,150 lb. for the rainfed and 19,120 lb. for the irrigated crop.

The heavy rainfall on the West Coast militates against sorghum being ever popular there, but all the same Periamanjal cholam has been grown with fair success at Taliparamba and on the Coconut Stations, both in the wetland areas and as a rainfed June crop on the modan lands (hilly upland areas). The yields, of course, have been very variable, ranging from 4,000 to 10,400 lb. of green fodder per acre, with an ever-present possibility of the crop getting swamped out by heavy rains. Further south at Pattambi, where the annual precipitation is nearly 40" less than at Taliparamba, the yields have been less variable, with an average of 4,750 lb. green fodder per acre.

In the Southern tract of Madura, Ramnad and Tinnevelly, where there are 265,000 acres of rainfed cholam and 136,000 acres of irrigated cholam, cholam is very important as a fodder crop. It is generally sown in September—October as a rainfed crop on the black soils, in rotation with cumbu the staple food crop and cotton the cash crop, and harvested by February. The seed rate is as a rule very high, sometimes going up even to 120 lb. per acre, although tests at the Koilpatti farm, point towards 80 lb. as the optimum. With higher seed-rates, the fodder which is already fine and thin-stalked gets still thinner and finer, but as the amount of grain recovered falls short of the seed sown, the practice is uneconomic.

The variety best suited to the Southern tract is undoubtedly the local irungu type *(Sorghum dochna* (Forsk) var *irungu* (Burkill, Snowden). This type is shorter in duration, more drought resistant and less susceptible to earhead bugs and sugary disease than Periamanjal cholam. Persistent attempts to introduce this on the Koilpatti Farm, have not met with success. Periamanjal does not also stand crowding so well as irungu does. Even when its yields do exceed the local type, the stalks are so much stouter and coarser that what is gained in outturn is lost in feeding.

After numerous tests, 6" between drill rows have been found to be the best spacing in this tract. The time of sowing, in a tract so completely

dependent on the north-east monsoon, is of course determined by the earliness or otherwise of the rains. Since, hardly any moisture is left in the soil by December, as a rule, the earlier the sowing, the better the yields. The crop is usually allowed to get fully dry before harvesting. The earheads are first clipped off and then the straw cut by sickles and stocked in the field for a day or two before being carted away and stacked up. It was found at the Farm that cutting the crop earlier, at the (shot-blade) stage itself, gave a definitely better quality of fodder, even though the outturn was somewhat less, and moreover the yield of the subsequent cotton was not so adversely affected as when cholam was cut after setting seed. But against this practice there were two very strong objections, one sentimental, the ryot looking upon it as something akin to infanticide, and the other practical, owing to his inability to recover any seed for subsequent sowings, unless by laying down separate seed multiplication plots. The average yield for a rainfed irungu crop in the black soils of the Farm, works out to 3,540 lb. of dry fodder per acre. On the red soils, under irrigation the yields are 5,500 lb. dry straw from a grain crop, and 19,100 lb. green material from a fodder crop.

Certain early trials with 'nitrolim' and 'fish guano' showed 46—60 % increases in yields, but later experiments (1930—1934) with ammonium sulphate and super-phosphate proved that manuring was uneconomic, as the increases were insufficient to cover the cost of fertilizers.

Besides the attempts to introduce periamanjal cholam, trials were also made here with certain foreign types as well. Thus, in 1915--16, a variety from the Belgian Congo was tried under irrigation and in 1932 a Bombay type, Bilichigan cholam was grown on the black soils, but neither had any success. The Belgian Congo type grew well enough, upto 10 feet in height and tillered very freely, was sweet stalked and well relished by cattle, but the seed setting was so poor that it had to be discontinued. The Bilichigan cholam was severely affected by 'calacoris' bugs.

On the Hills, although sorghum was a failure at Nanjanad, Periamanjal cholam has been a regular fodder crop at the Imperial Dairy Farm at Wellington and also in some places round about Coonoor (6,000 ft. above Sea level). The yields at the Dairy Farm range from 10,000 to 15,000 lb. of green fodder per acre.

Certain exotic types, such as "Chinese sugarcane" and "Planter's Friend" (at Saidapet in 1871), American types Red Kafir and Dwarf Milo in 1910 at the Central Farm, Coimbatore and *S. margaretiferum* in 1932 at Taliparamba, have been tested, but none of them have proved suitable for South Indian conditions. A few Bombay types of Jowar tried at Hagari in 1934, were found to mature earlier and thus escape the drought.

Sudan grass *(Sorghum sudanense)* was noted as promising at Hagari in 1917 and at the Central Farm in 1919; here it was sown in July and gave a single cutting of 9,100 lb. per acre in October, but dried up

thereafter and is not mentioned afterwards. This popular fodder grass of America and Australia does not seem to have a future in this Presidency.

Maize (*Zea mays*). Although this crop often equals sorghum in fodder outturn and is in some respects even superior, on account of its quicker growth, non-poisonous nature, and uniformity of yield all through the year, it is not so hardy or so widely adaptable to soil and climatic variations as sorghum. It was a common irrigated fodder on the Saidapet Farm, the yields varying from 12,000 to 17,000 lb. More recently, in the Northern Circars it has not been a success, either as an early or as a late crop, but at Guntur it has been grown regularly as a rainfed crop from 1923 onwards in both the early and late seasons, although the yields have ranged only from 1,640 to 4,100 lb. of green fodder. At Hagari it is an irrigated fodder since 1931, with an outturn of 4,350 to 11,600 lb. Consequent on poor yield of 2,200 lb. it was not continued at Nandyal, after its first trial in 1930. On the Ongole Cattle Farm at Chintaladevi it was a rainfed crop off and on from 1921 to 1932. The yields here too, as at Guntur, were only moderate, averaging merely 4,000 lb of green fodder per acre. On the East Coast, Palakuppam was the only place where it was tried and there it proved in 1927 an effective trap-crop for the parasitic weed striga. The next year, maize was grown in the same field and gave a striga-free crop of 4,900 lb. per acre At Coimbatore it has been a favourite forage crop since 1910 in maintaining a large dairy herd. Unlike sorghum, which tends to rush to flower, and gives a smaller outturn from sowings in September to January, the yields from maize are fairly uniform all through the year ; hence from August to January it is better to grow maize for fodder, reserving sorghum for the other months of the year. At Hosur also, maize has been a close second to sorghum as a main-stay of green fodder for milch cows, with an average outturn of 13,300 lb. It was observed here that if maize was cut and fed at the right stage, i.e , just when the cobs were forming, there was a marked improvement in milk yields. Once this stage was passed the feeding value deteriorated very rapidly, and it is therefore important to utilize this fodder just at the right stage. On the West Coast, maize was tried as a rainfed inter-crop in the coconut plots at Kasargod in 1930 and gave 3,500 lb. green fodder per acre. Further South at Pattambi, however, the yield was much poorer, never exceeding 2,000 lb. as a rainfed crop on *modan* lands. It was a failure in wetlands also. At Koilpatti it has occasionally been grown under irrigation in the red soil area. The yields were usually only moderate ranging from 3000 to 3,800 lb., except in 1936, when, consequent on a heavy dressing of poudrette, it shot up to 30,800 lb. per acre.

Teosinte (*Euchlaena mexicana*). This ancestor of maize from Central America was introduced at Saidapet about 1881, and in 1885 Benson reported on it thus : " It is doubtless a heavy yielder, but cannot withstand drought and is therefore limited in its scope to moist tracts or where irrigation is possible. The fodder is moreover very watery and devoid of any

sugary matter and is not quite palatable to stock." In 1932, it was introduced at Coimbatore and after trials at various other centres was found to be inferior to sorghum as a rainfed crop, although equal to it under irrigation. Contrary to Benson's report, however, it was very well relished by stock at Hosur, being distinctly sweet at the flowering stage and like maize capable of stimulating milk production when cut and fed at that optimum stage. At Guntur it gave 4,000 lb. green fodder as an early sown crop and 2,900 lb. in the "pairu" or late season. Cattle relished it better than jonna, but the outturn was less. At Palur too, the July sown crop was a success, yielding 34,800 lb. per acre and was about two weeks earlier than fodder sorghum, but the October sowings gave only 3,600 lb. Too much moisture in October proved detrimental to its success when sown in September at Aduturai (1932), but the March sowings fared better, and produced 6,200 lb. per acre. The average at Aduturai works out only to 4,100 lb, so that it cannot be classed as a great success in the Tanjore delta. At Coimbatore, teosinte has been grown regularly since 1932, but only on about 20–25 cents each year. The average yield comes to 28,400 lb. per acre, as compared to 21,100 lb. from sorghum. At Hosur, the yield was 25,100 lb.; at Taliparamba it was 20,800 lb. under irrigation, but the yield as a rainfed crop was only 930 lb. At Pattambi, however, both the irrigated as well as rainfed crops were failures. At Koilpatti also the dry land yields were disappointing, being only 1,500 lb. green, but the irrigated yields were better, averaging 10,200 lb. On the hills it has been a success. producing 19,500 lb. green fodder per acre.

Guinea grass (*Panicum maximum*). This grass, a native of tropical Africa was introduced into South India, about 1870 and has now become so well acclimatised as to be classed as one of the best fodder crops available. It is a tufted, profusely tillering, surface feeding, perennial grass that thrives best on well drained loams. With liberal irrigations and manuring it gives its first cutting six months after planting and thereafter continues to yield well for about three years without replanting, at the rate of seven or eight cuttings a year. It thrives well on sullage water and can also be conveniently grown along field bunds and sides of water channels, providing a nutritious succulent fodder for milch cows and young stock.

Napier's Fodder *(Pennisetum purpureum* old name—Elephant grass) is similar but often gets more rank and coarse than guinea grass. In 1872, a tall grass was noticed growing in the midst of a paddy crop at Saidapet, grown from purchased seed. The seeds from this grass, when collected and sown next year, gave the first cut within 83 days, with a total annual outturn of 21,000 lb. per acre. In 1917 this grass (*Pennisetum purpureum*) was reintroduced at Coimbatore with seed obtained from the South African Department of Agriculture and soon proved to be the heaviest producer of green material ever grown on the farm, the average annual yield of 99,200 lb.: being nearly twice that of guinea grass and four times as much as fodder sorghum. Although, on analysis it showed a higher moisture content, in

practical feeding it was found that the serrated leaf edges caused mouth-sores in cattle, so that they could not consume it in quantities sufficient for heavy work or milk production. Hence, guinea grass was on the whole the better fodder, though Napier's fodder was a heavier yielder. At Samalkota, guinea grass produced 86,500 lb. per acre per annum. At Guntur both the grasses have been grown regularly from 1931 onwards, on about half an acre of garden land, with an average outturn of 15,400 lb. At Hagari, the yields were poor in the beginning, being only about 4,500 lb. but after 1926, probably as a result of better cultivation, they have improved to an average of 13,000 lb. per acre. At Chintaladevi, guinea grass was both a rainfed as well as an irrigated crop with an yield of 5,000 lb. and 22,000 lb. respectively. Both the grasses have figured with success at Palur since 1917, guinea grass yielding 23.000 lb. and Napier's fodder 48,000 lb. The average cost works out to 356 lb. per rupee for the former and 462 lb. for the latter. At Tindivanam, guinea grass was somehow very poor, yielding only 3,200 lb. against 24,900 lb. from Napier's fodder; but at Aduturai they were both equally good, producing as bundside grasses an annual outturn of 37,600 lb. per acre. On the Central Farm, guinea grass was first grown in 1914 and within two years was recognised to be as good as or even better than sorghum as a forage crop, being semi-permanent, able to thrive on sullage water, and a heavier yielder than sorghum. The area under it rose from two acres in 1918, to about 12 acres by 1927. The average yield works out to 49,000 lb. and the cost to 570 lb. per rupee, as against 506 lb. per rupee for sorghums and 376 lb. for fodder maize. The cuttings were usually heaviest soon after the south west monsoon, and grew lighter with the approach of flowering during the cold months. Removal of flower heads as they appeared did not improve the fodder yields. As mentioned above Napier's fodder yielded nearly twice as much and so was cheaper to grow but being liable to get too rank and hard-stemmed, it had to be cut earlier. At Hosur, the two grasses have been grown regularly since 1925, with an average yield of 27,500 lb. for guinea grass and 23,900 lb. for the other. Being essentially garden land crops, they have not become very popular on the West Coast. They grew well enough during the monsoon months, but owing to lack of irrigation, got stunted from December to February, just when green forage was needed most. However, guinea grass has been grown at Pattambi along bunds and the sides of water channels. The cost of growing it worked to one Rupee per 655 lb. In the Southern tract, guinea grass has been regularly grown at Koilpatti on about 30 cents in the red soil area since 1917, the annual outturn per acre averaging 49,000 lb. in 6 cuttings.

The Lesser Millets as Fodder. *Cumbu (Pennisetum typhoideum).* Although the straw can only be classed as a famine fodder, the green crop is a very useful, short-period forage, eminently suited for making silage. As early as 1879, Benson observed at Saidapet that it " grew very well indeed under irrigation, yielding 15,000 lb. within a period of 75 days or so, although of course it was not quite equal to cholam either in quantity or

quality." It has been grown under irrigation at Hagari from 1930, with an average acre yield of 11,300 lb., while at Palur the conditions were apparently not so congenial that even as a rainfed crop from July to September the yields worked out to 7,600 lb. per acre. At Chintaladevi also it was a regular irrigated summer fodder, but the yields here were all very low, averaging only 2,300 lb. per acre, probably on account of the inherent low fertility of the soil. At the Central Farm, its usefulness was recognised as early as 1910. It was tested against fodder sorghum in 1933 and produced within 33 days an outturn of 31,000 lb. as compared to 15,000 lb. from sorghum in 104 days. Another advantage of cumbu over sorghum was that it could be cut and fed to stock at any stage of its growth, without danger of hydrocyanic poisoning. In spite of these, however, cumbu has not figured as a fodder crop in subsequent years. For the West Coast cumbu seems to be better suited than sorghum; a variety *Pennisetum leonis*, from Sierra Leone, was tried in 1933 at Taliparamba and grew very well, with an yield of 13,500 lb. as an irrigated crop in the wetlands. At Pattambi, local cumbu has been grown with success since 1930, yielding 9,100 lb. per acre and providing an excellent material for ensilage. In the Koilpatti tract, cumbu is an important food crop of the dry lands; on the farm, a variety from the Belgian Congo was tested in 1916 and found good as an irrigated fodder crop in the red soil area. Local cumbu has also been grown in the red soil, from 1930, and has yielded 16,300 lb. per acre on the average, although on the rainfed black soils, it was definitely inferior to irungu cholam as fodder.

Ragi (*Eleusine coracana*). Though third in importance among the millet food crops, this has not been tried anywhere as a fodder producer. The straw by itself is only an indifferent fodder, but it improves on ensilage and is then well relished by cattle. *Samai (Panicum miliare)* is another minor millet that has possibilities as a quick-growing fodder. At Saidapet it was reported in 1879, to have yielded 47,000 lb. per acre under irrigation, in two cuttings within 138 days. At Aduturai (1933—1936) it gave 13,200 lb. as green manure, within a period of 55 days, but it has not, somehow been tested any time, as a fodder producer, either at Coimbatore or at Hosur. It was tried at Pattambi without much success, but at Nanjanad it has been very successful, both as a grain crop (the Badagas preferring it to their time-honoured Korali (*Setaria pallidifusca* Stapf & Hubbard) as well as a green manure, along with lupins.

Other Grasses. Under this heading are included those intermediate between crops like guinea grass, that are cut and fed, and the genuine pasture grasses. Since, unlike temperate countries, the dry season in India extends from six to eight months (October to May), permanent pastures alternate in most cases between extravagance and penury. Thus, soon after the monsoon, from September till December there is more grass than anyone knows what to do with and later, just when fodder is needed most, there is only bare land, dotted here and there with semi-dry tussocks of grass

Under such conditions, the conservation of the monsoon flush, either as hay or as silage is the only solution. A number of grasses, both indigenous and exotic have been tried in this province, to evaluate their suitability for periodic cuttings, for hay and for making into silage. The more important of these are noted below:—

Kikuyu grass. (*Pennisetum clandestinum*). This was first tried on the Central Farm in 1924 and at Hosur, from slips obtained from the North West Frontier Province. It yielded 19,800 lb. per acre at Coimbatore and was noted as fairly drought resistant, but was less so at Hosur, and was discarded in 1926, as being more suited for pastures than for periodical cuttings. In the cooler habitat of the Hills, however, it fared better. Thus at Nanjanad, it was found to grow very well as a binding grass on bunds, and sides of water channels, able to stand both frost and water logging very well indeed.

Rhodes grass. (*Chloris gayana*), was grown in a small plot on the Central Farm in 1916 and gave great hopes but proved disappointing when grown the next year on a field scale. At Hagari too, it was promising at first in 1917, but suffered so badly from drought in 1919 that its cultivation was given up. At Hosur, however, it has been pronounced remarkably drought resistant, being in fact reported as not very happy at all under irrigations. The average annual yield here has been 10,800 lb. per acre.

Spear grass (*Heteropogon contortus*) This is the most prominent grass of the "grass lands" at Hosur, on about 800 acres each year with an average yield of 1,100 lb. of hay per acre. This crop too, is extremely hardy and drought resistant, being observed to be intolerent of more than 8—10% moisture in the soil. If allowed to ripen fully it becomes not only unpalatable on account of the hard 'spears' or awns, but also somewhat deficient in minerals and feeding value. Cattle consume such ripe hay only in quantities just enough for maintenance but not for any increase in weight or milk production. It is therefore preferable to cut it for hay before flowering, even though the outturn is somewhat diminished thereby, but this, however, was not always practicable, owing to rainy weather just then. It has therefore been necessary to supplement this ripe spear grass hay with other richer feeds. The silage too, from this grass was often found to be very dry, unless care was taken to cut it with the dew on, i. e., before eight in the morning, and pit it immediately. The hay could be rendered more palatable by first combing out the spears in the field by means of a special implement drawn by a single bullock. The grass is allowed to ripen just enough for the spears to get dry and become matted up by the wind, the comb is then set at the requisite height to engage these matted awns and drawn through the crop in the field. The combed-out awns are swept out at the head-lands. Various attempts to replace this grass by other more palatable grasses, at least in the more low lying fields at Hosur, were made but none was a real success. For example, Kolukkattai grass (*Cenchrus ciljaris*) was tried in 1926, but, though it came up well, it was not quite so

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drought resistant as spear grass. This Kolukkattai grass has also been tried with varying success at various places in the province but seems to grow best only in the Kangayam tract. Thus at Samalkota, it was reported to be a success in 1933, the only year it was tried there. At Guntur it was tried in 1926, but owing probably to an adverse season, it did not come up well and so was discarded. However, at Chintaladevi, although it took some years to get well established, it eventually proved quite good. No special mention is made of it at the Central Farm, Coimbatore, although some of the paddocks have been put under this grass since 1925.

Abyssinian Teff grass (*Eragrostis abyssinica*). This native of Transvaal was introduced in 1913 with seed from Kew and tried at the Central Farm at Coimbatore. It grew well enough and was relished by cattle, but was not firm rooted enough to stand cutting or grazing. The yields too were rather low and so it was abandoned in 1918. Another grass Efwatkala grass (*Mallinis minutiflora*) was got from Rhodesia in 1922 and grown on the Central Farm for five years. Under irrigation it yielded 17,300 lb. per acre per annum but this too was discarded, as it was found to be rather evil-smelling at certain stages of its growth and was then rejected by cattle.

(*To be continued*).

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Norwegian and Italian chickens of the same breed differ markedly in temperament, according to Professor N. Jaensch, of the University of Marburg. Professor Jaensch's description of the behaviour of northern and southern chickens reads almost like a popular statement of the difference between Nordic and Mediterranean human races. The northern fowl, he says, walks more proudly, goes quietly and directly on its intended course; the southern bird is more excited and agitated and dashes about moving its head continually. The Norwegian chicken eats until it has had enough and then quits; the Italian can be induced to overeat if it sees its fellow-fowls picking up grain.

A note on the melon cultivation at Sidhout.

By A. RAGHAVAN, B. Sc., Ag.

Agricultural Demonstrator, Sidhout.

Introduction. "Grow more fruit" and "eat more fruit" have become the slogan of the day. Fruit culture is becoming popular not only because of the increased money return it gives to the cultivator but because many have begun to realise the nutritive value of fruits. The old fallacy, that fruit is an article of luxury, is slowly giving ground. In this short note an attempt is made to give an idea of the cultivation of melon—a cheap, luscious and nutritious fruit which belongs to the family of cucurbitaceae.

When we talk of melons, we are reminded of Sidhout, since Sidhout melons are reputed to be the best in S. India. We can also reasonably suppose that melons were first raised in these parts, though this crop is now grown in many places.

Soil and temperature. Soil plays an important part in the cultivation of melons. Since the cultivation of this crop is done in only certain river beds it shows that certain special conditions of soil and temperature are essential for the growth of this plant. River beds with gravelly sand are not quite suited—fine sand with a very slight admixture of river silt is the best. Coarse sandy soil is often rectified by the addition of fine silt. The problem of drainage does not arise in river beds, but there must exist a sufficient subsoil moisture for the successful growth of this crop.

This being a summer crop, raised in Cuddapah district, it goes without saying that a fairly high temperature is essential. This crop comes up well in river beds of fine sand with plentiful underground water supply and a high atmospheric temperature. This plant is often spoken of as one "with a cool foot and a hot head".

Season and duration. This crop is purely a summer crop raised from the month of January onwards. Usually the cultivation is taken up after Pongal festivals. Even a slight shower or a cloudy weather is detrimental to the plant. The creepers present a sickly appearance if showers are received during the growing period; the fruits lose their normal taste if showers are received during the fruiting season. Hence bright weather is absolutely essential during the entire season. The duration of the crop is about 70 to 80 days.

Preparatory cultivation. Since melon cultivation is not assessed by the Government on the ground that it is a precarious crop, the right of cultivating a particular plot is decided by the priority in selection by the ryots themselves. When the water level in the river goes down the selection of plots is done. Usually the ryot raises his melon garden on the same place year after year unless three is a change in the course of the river. Gardens are laid out close to one another without leaving space between them. By

this method the gardener fences only three sides leaving the fourth to be fenced by his neighbour.

The preparation of the plot consists in levelling the sand and digging pits about 8″ in diameter and 3″ apart in the row, and rows four feet apart. The depth to which pits are dug depends on the layer where moisture is reached—since sites are selected close to the water course, the pits are generally shallow. Digging of the pits is done either with a mammatti or a sand scoop.

Seeds and Sowing. Seeds: Melon seeds generally keep their viability only for about an year. The practice is to collect good seeds from selected fruits and preserve them in ash. This is done by mixing the wet seeds with ashes and the whole mass is made into a cake and preserved by drying.

Nursery :— The seeds are not directly sown but only sprouted seedlings are transplanted in the prepared pits. Very near the water source, sand is excavated till the moist layer is reached. Melon seeds which were soaked overnight are thickly sown in these shallow plots and covered with moist sand; usually these nursery plots will not be more than a square yard. About the 4th or 5th day the seedlings which may measure about 2 inches in length will be ready for transplanting. These seedlings are transplanted in doubles in the prepared pits. A few cultivators prefer to spread a piece of cloth over the seeds sown in these pits and then cover the pits by putting a moist layer of sand of about an inch or two in depth. This is supposed to facilitate the easy removal of seedlings for transplanting without damage to the seedlings. When these seedlings are transplanted no watering is necessary since their roots are placed at such a depth where moisture is present.

Seed rate :— About 950 seeds go to an ounce. Twenty ounces will suffice for an acre.

Manures and Manuring :— The manures that are usually applied to this crop are farm yard manure, oil cakes, and birds droppings — The use of artificials is not known.

The first manuring is done while transplanting the seedlings when only a handful of well rotten cattle manure is put in each pit and mixed with the soil before planting the seedlings. After a week a mixture of birds droppings and farm yard manure is applied. The quantity applied is about a handful of the mixture for each plant. The manuring is done by scooping out the sand about 2 or 3 inches away from the plant on opposite sides and the manure put in. After another fortnight a third manuring is done as in the previous occasion but on the remaining two sides with a mixture of farm yard manure and oil cake. Still a fortnight later, a final manuring with farm yard manure and cake is repeated but with double the quantity used on the previous occasion.

Irrigation. This item of expenditure in the cultivation of melons is altogether absent due to the presence of the underground water supply. At

the time of transplanting the roots are placed at such a depth where moisture is present and so the necessity of watering at the time of planting does not arise. Subsequently, as the water table in the river bed goes down, the roots get deeper and thus there is a natural adjustment by the plant in procuring its water requirements. In this connection it is worth while remarking that melon cultivation will be successful only in river beds where the water level goes down very gradually. In other words, if the rate of downward movement of moisture in the river bed is high, the root development of the plant may not be possible to that extent to keep the roots in contact with the moist layer, the ultimate result being the drying up of the creepers.

After cultivation. This consists of earthing up and guiding the creepers. A week after planting, earthing up is usually done when manuring is carried out. This operation is repeated when the final application of manure is finished. After this, guiding of the creepers is attended to. Guiding is effected by burying one or two leaves in the sand and thus preventing the creepers getting blown by the wind. Fencing of the melon garden is another important item of work. This is usually carried out as an after cultivation after the creepers have flowered although it is done earlier, at times.

Flowering and fruiting. Melon creepers begin to flower by about the seventh week after planting. The flowers are small and axillary and are yellow in colour. Only a few flowers develop into fruits. Normally one or two fruits per creeper can be expected. But where more than one fruit is got, they are usually undersized. The fruits will be ready for picking in about a month from the date of flowering.

Varieties. More than a dozen varieties are locally known but no effort seems to have been made for the maintenance of the varietal purity. Many of the reputed varieties with very desirable qualities are sadly neglected for want of an encouraging market. The following few varieties are locally cultivated on a commercial basis.

Hingan. This is a good commercial variety the fruit is spindle shaped, orange red in colour when ripe, with coarse white netting and indistinctly ribbed. Hence the fruit is rough to feel. This usually measures 9 inches long and 5 inches in diameter. An average fruit will weigh about 4 lb. The variety stands transport best since it has a thick skin.

"*Laddukirni*". This is a small sized variety. The fruits are very sweet and hence its name. The fruits are round and smooth, usually greenish in colour even when ripe—The good sized ones will be about 4 inches in diameter. The only defect in this variety is its poor keeping quality and so does not stand long transport—These fruits are usually picked when half ripe for distant markets.

Jalbudama. This is the variety that produces very large sized fruits. They are spherical with rough skin having coarse netting. An average fruit measures 9 inches in diameter and weighs about 6 to 7 lbs. Generally this variety is not tasty and is usually put in where quantity and not quality

is required. The variety responds to nitrogenous manure as seen by the development of fruits.

The following are a few varieties that are also grown on a very small scale. They are Bathaskirni, Jamkirni, Burkaikirni, Thellakirni, Pappoye and Adamsha.

Darbija. This is a water melon grown on a commercial scale. The fruits are large and long in shape. They are dark green, smooth skinned and weigh about 10 to 15 lbs. Unlike in the musk melon the water melon is characterised by deeply lobed thin leaves, and the fruits have fleshy red pulp and black seeds when ripe.

Harvesting and Marketing :— In Melon gardens when the fruits ripen a watchman becomes necessary to reduce the damage to the fruits by jackals during nights, not to speak of the pilfering by the neighbouring gardeners. This part of the year being summer the whole family of the gardener prefers to sleep the night in the garden itself.

The period of harvest will extend over a fortnight. The fruits come to harvest at one time, so much so the marketing is found difficult. Unless the prices are favourable, the cultivator is put to loss since the produce has to be disposed of soon after harvest. The adjoining taluks like Badvel, Rajampet and Cuddapah are the usual market. The cultivators themselves cart the fruits to the market and effect the sale. Sometimes wagon loads of fruits are sent to Madras market but this is being slowly given up for fear of incurring loss. Marketing facilities through co-operative movement for better prices do not exist and individual enterprising gardeners occasionally effect sales in distant markets.

Pest and diseases. There are not many pests and diseases for this crop. Rust on leaves is noticed but damage is not much. The pests that really do damage are the plant lice. Spraying or dusting is uneconomical considering the value of the creeper. Very badly infested leaves are removed.

Due to the application of oil cakes to the creepers, fly breeding is accelerated. The manure, due to the presence of moisture rots emitting an offensive smell. Attracted by the smell the flies breed by laying eggs in the rotting cake. These flies attack the cattle. They have long proboscis and cause annoyance by puncturing the skin. These flies are identified to be '*Stomaxys calcitraus*'. The cattle become restless. Usually the field operations during this period cannot be carried out during the daytime. The mhoting is done at nights.

Conclusion. We find that the area under melons is slowly dwindling down year after year due to various factors. The most important of these is the glut in the market and consequent low price. Gardens are raised at different periods to overcome this but the practice of raising gardens throughout the summer to have a continuous supply to the market is not in vogue ; the floods are expected at any time from the month of April onwards and the damage of submergence of the crop then always exists.

Since the fruit is a delicate one, which easily gets damaged during transit to distant market, air conditioned wagons for quick and safe transport have to be provided by the railway authorities. Also, investigation and later on propaganda work in the direction of preservation of fruits either by canning or preparing products like squashes, have to be made, since the fruits are available in plenty and are cheap.

The economics of melon cultivation.

Details of expenditure (for 1000 plants in 10 cents)

1. Preparatory cultivation:—				
(a) Levelling the sandy bed and making small pits at a contract rate of 0—2—6 for 100 pits—for 1000 pits.	Rs.	1	8	0
2. Manures and manuring:—				
(a) About 2 cartloads of Farm yard manure at 1—8—0 per cartload.	Rs.	3	0	0
(b) About 200 lbs of birds dropping.	Rs.	3	8	0
(c) 10 maunds of oil cakes at 12 as. a md.	Rs	7	8	0
(d) Labour charges for manuring:—				
i. Manuring at the time of of transplanting the seedlings.	Rs.	0	8	0
ii. Manuring with birds droppings a week after transplanting.	Rs.	0	8	0
iii. Third manuring with a mixture of cattle manure and oil cake.	Rs.	1	0	0
iv. Final manuring (same as in iii)	Rs.	1	0	0
3. Seeds and sowing:—				
(a) Cost of seeds—(local rate) L. S.	Rs.	0	7	0
(b) The cost of raising nursery and transplanting the seedlings.	Rs.	0	8	0
4. After cultivation:-				
(*a) Labour charge for earthing up a week after a planting.	Rs.	0	8	0
(b) Second and final earthing up.	Rs.	1	0	0
(c) Providing thorn fence—cost of thorn and labour.	Rs.	1	0	0
(d) Night watchman during fruiting season.	Rs.	4	0	0
5. Harvesting:--				
This includes the marketing charges also. Local practice is to sell the garden and the purchaser does the harvesting. Hence under this item L S. is provided.	Rs.	3	0	0
	Rs.	29	0	0

Details of income.

The cost of 1500 fruits at 2—8—0 per 100 (local delivery).	Rs.	37	8	0
Profit.	Rs.	8	8	0

N.B.—1. A family of four with one male member can manage a garden of 1000 plants.

2. In the case of private gardeners items 2-(a), 3-(a) and 4-(c) are not to be included. The seed is collected and preserved from the previous crop and the watching is done by the members of his family. The cattle manure is got from his farm.

3. The profit in the case of private gardeners will be (7—9—0+8—8—0) 16--1—0 in addition to providing labour for the entire family.

Cultivation of Rice and the best Method of Marketing.

By M. GOPALA CHETTY, L. Ag.,

Agricultural Demonstrator, Chidambaram.

The subject, it is needless to say, is of paramount importance to the ryots of the Madras Presidency. About 10·5 million acres are cultivated under paddy at present. There are vast deltas under Cauveri, Godavari and Kistna systems of canal irrigation. It is also cultivated under lift irrigation as in Salem and other districts. But the area under it may be small. It is computed that about 75 % of the population take the rice diet in this Presidency and we may assume that this percentage will increase as the standard of living increases and more and more area is brought under irrigation projects. Rice in this Presidency stands in the same relation as wheat to North Western India. In North India wheat is the common staple food of about 75 % of the population. Rice will continue to be the main cereal of consumption in this Presidency and it will not be replaced easily by any other cereal.

It therefore naturally attracted the attention of the Agricultural Department right from the beginning and it set about to improve rice growing and production. Surveys of rice cultivation were made and a number of research stations was established in different parts of the Presidency as finance permitted, to study the local conditions and improve the local varieties. The needs of the Districts in this Presidency were separately met by establishment of Rice Research Stations. Generally speaking the varieties suitable to one locality are not generally suitable for other localities. To give an example the famous Tanjore *Sirumani* is not suited to Salem District and vice versa. The varieties of Malabar are not suited to the conditions of Tanjore and South Arcot districts and therefore there is the need to group together certain districts and find out suitable varieties for these districts. The time and money spent in search of such strains are well spent and will be amply rewarded in future as they have done in the past.

There are three different breeding methods by which best strains are selected. Firstly, Nature by its mysterious working may throw out a strain as for instance G. E. B. 24. It is a mutant which a breeder discerned, isolated and improved upon. The strain has established its fame and has spread to many parts of the Presidency, not to mention its rapid spread in the adjoining states of Mysore and Hyderabad. It is a very good table rice and it has other desirable qualities, such as ability to stand drought, and non-shedding, resistance to *Piricularia* and foot rot diseases. It is also non-shedding. It is not possible to have all good qualities in a single strain. G. E. B. 24 paddy has the drawback of giving less straw. I mentioned G. E. B. 24 as a sport of nature. Such mutants are very rare and noble nature sheds such bounties only once in a way.

The second method is to examine and select good single plants from an existing variety, (isolate) grow them separately, repeat the best selections from them, and establish finally one or more strains. This is done by experts who have intimate knowledge of rice growing. It will require good deal of time and patience to evolve a strain in this manner.

The third method is more intricate and highly technical. It is only highly trained technical experts that could handle and bring about select strains and it is called hybridisation. By this method it is possible to combine different desirable characters in the same strain. The Research stations are engaged in the last two methods and have already evolved a good number of strains suitable for the Presidency and have released them. These strains have given 10% to 20% increased yield over locals and have spread very much in all rice growing tracts. In Tanjore, Trichinopoly Madura, Tinnevelly and parts of South and North Arcot Districts etc., in the south, in Godavari, Kistna etc. in the north, improved strains of paddy strains have spread. In some parts of these districts they have completely replaced the local varieties and in others in varying degrees. In fact in paddy it is not possible to collect figures of improved strains for the area is increasing from year to year by the efforts of departmental officers as well as by the initiative of the cultivators themselves. The Department is doing its best to spread these strains and it is in fact one of the main items of its activities. In all the Taluk Headquarters Depots, the seeds are stocked and sold. The demand has been so great now that it is not possible to meet all the requirements from Research stations. Paddy seed-farms have been started by the Department, improved seeds have been purchased locally and sold to meet the increasing demand. Organised seed multiplication schemes are also under consideration of the Government. As finances permit they will be given effect to. By these schemes, rapid spread of the strains will be effected I may mention here that it is not enough to purchase a superior strain and grow it in the usual way; scrupulous care is to be taken to maintain the purity of the strain. At first only a small quantity is purchased which we multiply to the entire area at our command. It is good to do so, for the single reason that it is economical and at the same time we get the seed acclimatised to our soil conditions and climate.

Paddy is one of those seeds which get easily mixed up in the nursery in planting, harvesting or in the thrashing floor. drying yard, storing etc. and requires all our vigilance to keep the seed pure. Seed selection and storing should be attended to personally by those interested and not left to those who handle them carelessly and who by ignorance or otherwise do not attach much importance to the purity of the seed. I need not go into details of the advantages of pure seed and the importance it plays in successful agriculture. With all the care and vigilance exercised paddy seed gets mixed up with other seeds in course of time and it is better the seed is replaced once in four or five years. Apart from mixing, the seeds get deteriorated and lose their original good qualities as for instance a fine

seed gets course or disease resistant variety develops a new disease. Such changes are naturally governed by environmental conditions and we have to change or adopt new strains to the different conditions. Therefore what a strain is to-day may be entirely different in years to come and we must be changing with nature.

Where is the need for improvement and increased production? The question has been partly answered. It is wrong to suppose that we are over producing. Our population is increasing as also our consumption, and the standard of living increased with the introduction of prohibition which is to be extended soon over the whole Presidency. Salem district, it is said, is now consuming more of staple food articles such as rice etc. and is drawing its supplies from the adjoining districts chiefly from Tanjore, Trichinopoly and South Arcot. People who used to take *ragi* and *cholam* are now getting more and more of the urban touch and are going in for a rice diet. When the whole presidency goes dry, one can imagine what a tremendous demand is going to be created for rice, so that all the quantities of rice you are going to produce will still be found short. There is a great future for rice and rice growing tracts.

Further, I need not emphasize the importance of increasing our yields with less cost in these days of economic depression and low prices. It did not matter when prices ruled high and when one *Kalam* of Paddy (24 M. M.) was selling at Rs. 4. In those days we could have afforded to forego a bit of production capacity. What was lost in yields was then made up in price. But now when prices have gone down considerably, it is important that the ryots should wake up and increase their production.

It is therefore a sound proposition for acceptance that the yield of paddy per acre should be increased and we shall presently consider ways and means how increase in yields could be effected. It was already stated that by using improved paddy seeds, 10% to 20% increased yield could be obtained by mere change of seed alone. The improved seed may cost a little more than the local seed and that is worth paying for.

By proper cultivation of wetlands with light iron ploughs, it is possible to decrease the cost of cultivation and increase the yield by about 5 %. I mention here, the use of a plough like Cooper No. 25 for wetland cultivation. It is a handy and light plough for using in wet lands and has been found useful. In Chidambaram Taluk more than 200 ploughs are at work and those mostly in wetland cultivation. It suits the local cattle which are small sized animals and also the nature of wetland soils largely. Locally the ryots use a very small wooden plough and sometimes without the iron share resulting in poor and imperfect cultivation. The chief objection raised by ryots against the use of the iron plough is that, their cattle are of small size and even the lightest iron plough gets down deep into the mire in the puddled land and their cattle are unable to cope with the drought. This might hold good in certain cases but wherever conditions are better, it is certainly advantageous to use light iron ploughs and increase the yield.

By adopting improved cultural methods as for instance thin sowing and economic planting, yield could be increased by about 5 %. Further about 60 % in the initial cost of seed per acre is saved.

This improvement of raising thin nursery and adopting economic planting is as old as the Department itself and now vast areas are planted economically in many paddy growing tracts of the Presidency.

By judicious manuring yields could be increased. I am referring here to that aspect of green manuring by growing crops like *daincha, indigo* and *kolinji* and *pillipesara*. It is a known fact that paddy responds to green manuring and in combination with bonemeal or superphosphate the yields could be increased up to 10 % to 25 %. Different soils require different green manure crops. There are certain disabilities which work against growing green manure crops. As for instance *sunnhemp* and *pillipesara* and at times *daincha* are crops liable to be grazed by cattle unless protected by proper fencing or by watch over them. As fencing system is absent in the delta area, it is possible to get over the difficulty by co-operation. If ryots in a village co-operate and sow their green manure crop in a compact block it is possible to grow *daincha* or *sunnhemp* successfully and on large scale. Cultivation of *sunnhemp* for fodder after rice between December-February, in northern districts is a case in point. It is then possible, if necessary, to keep a common watch against cattle trespass. I might cite an example near at hand in South Arcot District. In a village called Modaiyur, Chidambaram taluk, a few ryots joined together last season, got about 20 bags *daincha* seed collectively and sowed about 100 acres in a compact block. It was cut simultaneously and composted. This is a good instance, where co-operation could really help. If one or two ryots had attempted to grow the crop separately, it might have ended in failure. I have now shown how we could increase the yields by using improved seed, by good cultivation, proper manuring etc.

By adopting all the improvements systematically and judiciously it has been in course of years possible to increase the yield of paddy by about 75% more. Records of the Agricultural Research Station, Palur and Central Farm, Coimbatore show that, where a variety yielded 1800 or 2000 lbs. per acre 20—25 years ago, it now yielded 3500 lbs. and more. This shows that by systematic farming and good cultivation we can increase the yields considerably.

Marketing. But it is not enough if we are merely able to produce a certain commodity. Mere production in any scheme of national regeneration will not solve the problems of poverty, indebtedness etc. unless those products are simultaneously marketed to the best advantage. The problems of production and marketing are knit close together and they have to be solved together. How best to market the produce should engage the attention of Rural Development workers as well as the State. Ryots who are generally poor are confronted with expenses specially when their paddy is

about to be harvested or just after it is harvested. They have to pay Government kist or celebrate a marriage or pay a pressing debt which cannot be postponed. They are compelled to take loans at exhorbitant rate of interest from the *sowcars* or sell their new produce when the prices are usually low. They cannot afford to wait for better prices. It is in this way one and all from a rich Mirasdar down to an ordinary ryot are suffering. It is here, where real help is needed either from public bodies or corporations as in the west or from the State. We do not find in our country, such institutions as in the west where co-operative bodies are formed from public funds and help the societies. The burden here largely falls on the State.

Government has therefore come to the aid and formed co-operative societies, known as Loan and Sale Societies, for the benefit of the growers. The Loan and Sale Society will advance loans to the ryots or members on the security of the produce say at 6% interest. The society itself will be financed by the Central Bank at 5% interest. The produce will be sold either by the individual, better still by the Society itself when prices rule high. The Society will then recover the advances paid with interest and the balance handed over to the member. In this way, the member is helped not only to tide over the financial difficulty but is also materially benefitted with extra profit which he gets by selling at favourable rates and further we do away with the middlemen who more or less, like vultures, snatch away the extra gain which really should go to the actual tiller of the soil. As an example, I cite the paddy loan and sale society which is working at Chidambaram very successfully. This is the third year of its working. During the year 1938 the Loan and Sale Society disbursed loans to the extent of Rs. 75,000 in 21 centres among 245 members. The profit, the members got was as much as 10% to 40% extra. The paddy which was selling at the time of pledging at Rs. 1—8—0 per *Kalam* only, was sold later on at 1—12—0 to Rs. 2—8—0 per Kalam. Therefore if paddy could be held up for better price with the aid of a society, it could be sold subsequently at a great profit. It is therefore upto the ryots to follow such example, form Co-operative Loan and Sale Society and benefit themselves.

The Marketing section of the Agricultural Department is trying to improve marketing conditions for paddy. It has made surveys of the rice growing areas in the presidency and is trying to find out ways and means to market the produce to the best advantage of the producer. It has begun to introduce grading of rice in Tanjore District and sell the graded produce at some premium in foreign markets. It has already begun to function and has done some useful work in this direction but much remains to be done. The marketing section is actively engaged in solving several problems connected with marketing of rice and it is hoped that ere long the ryots will have the full benefits of its labours.

SELECTED ARTICLE.

Deforestation and Soil Erosion in Trinidad.

DEFORESTATION AND SOIL EROSION IN THE FOOTHILLS OF THE NORTHERN RANGE CAUSED BY SHIFTING CULTIVATION.

By J. C. Cater, Assistant Conservator of Forests.

The Foothills Region. A recent, and perhaps somewhat superficial, survey has been carried out to determine the amount of deforestation that has taken place in the foothills of the Northern Range, since there is sufficient evidence of erosion to give some cause for alarm. The area surveyed has embraced all the land south of the main ridge of the Northern Range between Maraval on the west and Tacarigua on the east. It is true that there are erosion problems elsewhere in the Northern Range, but it was felt that the area indicated above presented by far the most difficult problems.

There is extremely little flat land in the foothills region, about 75 per cent. of the area is over 500 ft. above sea level and about 25 per cent. over 1,000 feet above sea level. Most of the slopes are very steep, some even precipitous, Roads are confined to the valley flats, but bridle tracks lead up from the roads to the ridges. The rainfall is somewhat variable, being about 70 to 80 inches per annum in the valleys and considerably more on the hilltops. South of the foothills the rainfall drops rapidly to 50 to 60 inches per annum. In normal years nearly all the rain falls during the last 7--8 months of the year, and on occasions the rain is extremely heavy. The period January to the beginning of May is usually marked by a drought, when the vegetation becomes tinder dry.

The soils of the foothills are derived from mica and quartz schists, and from the occasional lime-stone masses such as are found at Laventille and Caneron. Owing to the steepness of the slopes, erosion takes place at such a speed that a proper soil profile is never developed, even under high forest. The hillside soils are very shallow, often with the parent rock only 6 inches below the surface, and where serious erosion has taken place the shallow soil is studded with boulders. Were it not for the fact that the mica schists decompose very rapidly on exposure to the elements, there is little doubt that much of the steeper hillsides, where serious erosion has followed persistent cultivation, would consist of the bare rock. The Soils, particularly those derived from the quartz schists, are by no means fertile, but ·here are deeper and more fertile soils in the valleys between the hills.

Thn Vegetation. The original vegetation supported by the foothills before the advent of the human race to the island, almost undoubtedly consisted of tropical evergreen rain forest, with a proportion of deciduous and semi-deciduous species, such as cedar (*Cedrela mexicana*), cypre (*Cordia alliodora*), poui (*Tabebuia serralifolia*) &c. Balata (*Mimusops balata* var. Cruegeri) was probably common, as it is still plentiful on the seaward side of the watershed. The last remnants of this forest can be seen on the upper slopes of the Santa Cruz valley near St. Ann's peak, and further east in the Tacarigua proposed Forest Reserve.

During the period of Spanish ownership of the island, the forest in the valley bottoms was cut down and replaced by cacao plantations. After the advent of the French refugees, about the time of the French Revolution of 1793 and later the arrival of English colonists, when Trinidad became part of the British Empire, more forest was cut down in the valleys and on the lower slopes and cacao was planted. A certain amount of cacao was even planted at the

higher elevations, and there are to-day cacao plantations at an elevation of 2,000 feet above sea level on Morne MalD'Estomac at the head of the Maraval Valley.

In the main, however, cacao was confined to the valleys and the lower slopes, and there was never any considerable permanent cultivation of the middle upper and slopes of the foot-hills. For a considerable time past a very large proportion of the slopes of the foothills have been subjected to severe shifting cultivation, which has destroyed almost all traces of the original forest vegetation. To-day the vegetation over most of the foothills consists of a very poor type of second growth containing numerous palms such as gru-gru (*Acrocomia aculeata)* and the trash-palm (*Sheelia osmantha*). The commonest trees are bloodwood *Croton gossypifolius* balsa (*Ochaoma pyramidale*), saltfishwood (*Machaerium robinifolium*), gommier (*Tapira guianensis*), and kiskidee (*Vismia falcata)*. Shrubs are numerous and frequently the whole mass of vegetation is closely tied up with vines and razor-grass. The bush becomes tinder-dry during the normal dry season and is very liable to be overrun by fires. Small patches of bracken (*Pteridium aquilinum)* can be seen on the hills to the north of Port-of-Spain, and further east. Between 700 feet and 1.500 feet elevation, there are areas of savannan similar to the Piarco and Mausica Savannahs. There the dominant grasses are *Trachypogon plumosus* and *Thrasya robusta*, while a sedge, *Scleria sp*., and a coarse grass, *Axonopus equitans*, are also found. The grasses are tufted, with eroded channels between the tufts. The dominant shrubs are *Curatella* and *Byrsonima*. The bracken patches are almost certainly the result of continuous shifting cultivation and fires which have resulted in severe sheet erosion of the originnally shallow soil. It is not known if such areas can eventually revert to forest, but the process of re-establishment is likely to be very slow and probably depends very largely on the prevention of fire. At present fires occur almost every year.

The origin of the hill savannahs is not known with certainty. They may be the result of continuous shifting cultivation and fires, but there is some historical evidence to show that they may be a natural phenomenon, since a Spanish adventurer of the 16th century has recorded that he sailed up the St. Joseph River and eventually reached a natural savannah from which he obtained an extensive view of the island. It is of course possible that the savannahs are the result of human activities long before the advent of the Spaniards to the island.

Cultivation. The methods of cultivation of the hill slopes are wasteful and primitive in the extreme. During the dry season the bush is cut down and burnt. The law requires that fire traces at least 25 feet wide shall be cleared all round a parcel of land which is to be burnt, but adequate precautions are not always taken and frequently fire escapes from the area to be cultivated into the neighbouring bush, and large areas are damaged. No attempt is made at contour-ridging, terracing or planting in lines along the contours, and the extreme steepness of some of the slopes is not deterrent to the would-be cultivator. The fear of praedial larceny drives many cultivators to utilise land at very high elevations, in the hope that the difficulty of extracting the harvest from such situations may deter the thief, who will confine his attentions to the gardens at lower levels.

The burnt land is sown or planted when the rains break, usually during May. The land is then completely bare of vegetation and the heavy downpours play havoc with the exposed soil. Very large quantities of surface soil are removed by sheet erosion and carried down the slopes. Gullying also takes place to some extent, but does not seem to be so severe as sheet erosion. It is by no means uncommon to find stones which were originally on the surface supported, after heavy rains, on a pinnacle of soil two inches or more high. The eroded soil gradually makes its way down the slopes during successive periods of rain and

is eventually deposited on the low-lying lands or carried out to sea. After rain has fallen in the foothills, the rivers which drain them are loaded to capacity with silt and change within the hour from gentle streams to roaring torrents which overflow their banks and floods the flat land in the Caroni plain, destroying small houses and rendering roads impassable.

The crops commonly planted are sweet corn, tomatoes, carrots, chives, yams, &c. They have little effect in decreasing the speed of surface run-off water which is not absorbed by the soil. Usually the crop is reaped within six months of planting. A second and sometimes third crop is grown on some land, but often the land is abandoned after one crop, when erosion and the needs of the crop have exhausted the fertility of the soil. The abandoned land gradually reverts to bush through the invasion of plants from neighbouring areas of second growth and the coppicing of stools not destroyed by fire. After the land has rested for a number of years, usually from three or seven, a certain amount of fertility is built up under the cover of the second growth, and it is again cleared for cultivation.

Ownership of Land in the Foothills. Unfortunately the reservation of land as Forest Reserves did not commence until the beginning of the twentieth century when nearly all the land in the western foothills had been alienated. To-day there are under 2,000 acres of land owned by the Crown in the foothills between Maraval in the west and Tacarigua in the east. The rest of the land, some 28,000 acres of which lie above the 500 feet contour, is divided between small and large proprietors in the rough proportion of 2 : 1. The renting of lands for shifting cultivation is quite an important item in the revenue of many of the estates, rentals varying from 2·00 per acre to as high as 8·00 per acre.

Suggested Methods of Control. Shifting cultivation and its attendant evils have now reached serious proportions in the Northern Range foothills, and it is highly desirable that some form of control should be introduced to protect the community. To decide what form the control shall take, however, is not an easy problem. Considerable quantities of food are grown on the foothills, an important matter to a community which is largely dependent on imported foodstuffs, and it is most undesirable to reduce the total land area under cultivation of locally consumable crops.

One method, and the most drastic, springs to mind at once. It is to prohibit all cultivation of the shifting type on land lying above the 300 feet contour, and allow the land to revert to forest. This would undoubtedly result in an enormous reduction in soil erosion and flooding. To compensate for the loss to cultivation of some thousands of acres of land, it will be necessary to find suitable land elsewhere. This should present no insuperable difficulty. Apart from the large areas of derelict land throughout the Colony, where, in spite of the low fertility of the soils, crops of vegetables could be raised under a system of controlled shifting cultivation there are thousands of acres of abandoned or almost worthless cacao plantations on somewhat better soils. Such cacao produces a negligible crop, which it is not economic to harvest, and even requires a considerable expenditure of public funds in the form of a subsidy to maintain it at all. This cacao could be cut down and replaced by a mixed animal and vegetable crop husbandry which would afford a decent return to the cultivator and be of great value to the Colony.

An alternative, less drastic and probably less effective method of dealing with the problem, would be to permit cultivation of the slopes up to a higher elevation, say the 500 feet contour, and try and educate the cultivators in measures which would reduce the rate of surface water run-off and hence erosion. Research work is required to determine what measures are most effective and

economical in preventing erosion, and it is suggested that terracing, contour ridging, planting along contour strips alternating with strips left in bush or grass, and the use of a grass-sod of species having a prostrate form through which the crop is planted in shallow holes should, among other methods, form the subject of experiment. No cultivation of temporary crops should be permitted above the 500 feet contour, but the cultivation of orchard crops such as tonka beans, limes, &c., might be allowed between the 500 feet and the 800 feet. contour, provided the soil was protected by an adequate grass cover and drains were properly aligned and constructed. Above the 800 feet contour no cultivation of any crop other than cocoa should be permitted, and as much of the land as possible should be allowed to revert to forest. The process of reversion to forest could be accelerated by tending operations such as vinecutting, removal of excess coppice shoots, &c. Whatever form of control of cultivation in the foothills is adopted, there is no doubt that the sooner the control begins the better for the welfare of the Colony.

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The Rape of the Earth.

A WORLD SURVEY OF SOIL EROSION.

By G. V. Jacks and R. O. Whyte, London, Faber and Faber Ltd., 1939. pp. 301 and Index, with 47 photographic reproductions. Price 21s.

(Review F. H. in Tropical Agriculture Vol. XVI No. 10. P. 223—225.)

In the opening chapter of this book, Mr. G. V. Jacks, the Deputy Director of the Imperial Bureau of Soil Science at the Rothamsted Agricultural Experimental Station, England, gives a very readable account of the modern aspects of soil erosion, in which he particularly stresses the broad economic relationships of the problems of land maintenance. " As the result solely of human mismanagement, the soils upon which men have attempted to found new civilizations are disappearing, washed away by water and blown away by wind...Already...nearly a million square miles of new desert have been formed, and a far larger area is approaching desert conditions ". Despite the invention of efficient agricultural implements, the introduction of better varieties of crops, and the increased use of manures, the average output of the land per unit area taken the world over, is rapidly diminishing : this is mainly attributed to the ravages of soil erosion which " is altering the course of world history more radically than any war or revolution ". Nevertheless, soil erosion is a beneficient process without which the world would long ago have died, being Nature's way of discarding its old worn-out skin and renewing its living sheath of soil from the dead rock beneath" In Nature, it takes place slowly, so that equilibrium is always maintained between soil removal and soil formation under particular conditions of climate. *It is the great acceleration of erosion through human mismanagement that has changed the process into " one of the most vicious and destructive forces that have ever been released by man ".* Deforestation, the destruction of natural herbage by over-grazing and excessive cultivation may so hasten soil removal that fertile land, taking centuries to form, may be entirely lost within a year or even a few days.

Until recently, soil erosion was regarded merely as a local matter, but it is now recognised as " a contagious disease, spreading destruction far and wide ",

and affecting almost every contagious diseases, soil erosion is most easily checked in its early stages; when it begins to threaten an entire social structure, its control becomes very difficult, though at this advanced stage, it may have assumed such serious and spectacular proportions that eventually whole nations, have been roused to exert supreme efforts to combat the menace to their economic security. Thus, in the United States of North America, soil erosion has become a dominant factor in national life and here the greatest attention is now being paid to solution of its many problms.

It is a peculiar circumstance that the systematic intensive cultivation of soils, successfully evolved in Western Europe where modern civilization had its birthplace, has proved elsewhere to be unsuitable as a basis of economic development. No sooner has European civilization been established in a new country than soil erosion, the invariable destroyer of past civilizations, has set in with usual disastrous results. The probable reason for European immunity to soil erosion lies in the fact that the system of cultivation that was evolved in Western Europe is particularly adapted to the prevailing climatic conditions; it has been the aim there always to maintain soil fertility, and, if possible, to augment it since the profits gained usually vary in direct proportion to the amount of labour put into the land. In other regions, notably the New World, circumstances have been entirely different; profits have been made mainly by exploiting virgin soils notably prairie grass lands. Such treatment rapidly exhausts even the most fertile soils, which soon become eroded beyond repair, a result attributable to the "general maladjustment of land-utilization practices to the natural environment" since man has not yet proved himself capable of modifying European agricultural systems to suit the new climatic and economic conditions.

Loss of soil fertility is generally accompanied by loss in soil stability, caused primarily by the removal of protective natural vegetation. This deterioration in physical properties is the invariable precursor of erosion, and is manifest chiefly in a reduction of water-holding capacity favouring run-off rather than downward percolation and storage of rain-water. The deterioration is progressive and soil erosion in consequence becomes more and more devastating until finally deep gullies dissect the once fertile fields and recurrent floods overflow the country. "The consequences of erosion by water may be summed up as the localized reduction of productive capacity due to direct losses of soil and of soil moisture, and the general dis-organization of whole regions resulting from the cumulative dislocation of the natural water regime".

Wind erosion though less widespread differs but little from water erosion in its ultimate effects, and, like it, "upsets the equilibrium existing between "the life and the climate of a region". Together they have "made a knowledge of the underlying principle of human ecology one of the most urgent needs of mankind"; ....."unprecedented land wastage......has set us, with our vast powers, a task that can profitably occupy the surplus human energy released......by the advance of science". "New outlooks, new aims and new knowledge will be required before the earth is again fit to rear......another civilization".

These few quotations from the introductory chapter amply indicate the outlook of the authors of this long-needed book. The chapters immediately following are devoted to the presentation of facts concerning different geographical regions that serve as illustrations to the general theme. In Chapters II to V, Europe and the Mediterranean Region, North and South America, Africa, Australia and New Zealand are considered in detail by Mr. R. O. Whyte, Deputy Director, Imperial Bureau of Pastures and Forage Crops, Welsh Plant Breeding Station, Aberystwyh, while India, China and Japan are dealt with by Mr. Jacks in Chapter VII.

The chapter following (Chapter VII), by Mr. Jacks, discusses the influence of soil on erosion, and attempts to define such terms as "erodibility" and "soil structure". It is here pointed out that "The more favourable the natural external conditions (climate, slope, vegetation) are to erosion the more erosion-resistant the soil itself will become", an axiom which is well illustrated by the characteristic occurrence in the wet tropics of non-plastic, crumb-structured red earths which are known to be little affected by erosion.

The principles of soil conservation are next considered briefly (Chapter VIII G. V. Jacks), with special reference to the now well-known methods of terracing contour-forming, strip cropping, and damming for flood control in river valleys. The reclamation of gullies and the value of grass and of treess in soil conservation schemes are discussed in four more chapters, and dunes and deserts form the topic of Chapter XIII, all by Mr. Whyte, while some special aspects of conservation (flood control, Chapter XIV; road construction, Chapter XV; and wild-life preservation, Chapter XVI) are next considered by the same author.

The social consequences of unchecked soil erosion must necessarily be profound, since they arise from the maladjustment of agricultural communities to their environments. Maintenance and restoration of land fertility often involve an alteration of the conditions of land tenure. Two main sociological problems are outlined and discussed by Mr. Jacks (Chapter XVIII) in this connection; the first concerns semi-arid grasslands; the second problem, and the more difficult one, concerns the tropics, exemplified particularly by East Africa. In the first example, people of European stock who occupied *semi-arid grasslands* easily accommodated themselves to their environment and usually assimilated the native races. Their struggles and progress in Russia and in North America are related in Chapter XIX, where the varying degrees of economic success of different political systems (capitalism, collectivism, socialism) are fully described In the second example, Europeans who colonized *tropical Africa* exercised little caution, believing that the luxuriant vegetation, which is so characteristic of most parts of the tropics, indicated potentially rich soil that could be directly exploited without fear of deterioration. The fallacy of this assumption has been increasingly recognised in recent years, for the rapid onset of soil erosion has made the European settlers and administrations fully alive to the impending disaster. Moreover, the colonists have not been able to assimilate the native populations which subsequently became segregated in reserves where they now practise a mixture of traditional shifting cultivation and modern agriculture highly conducive to soil erosion. The development and ecological results of this relationship in tropical Africa, are clearly described by Mr. Jacks in Chapter XX, comprising one of the most illuminating sections of the book, "Only exceptionally is the white man or the black man the dominant species in a tropical environment ... (In Africa), shifting cultivation ,.., was the only system under which (native) races could safely cultivate the tropical forest, and nomadism the only system under which the grassland could be safely pastured...To-day, shifting cultivation, the sign of man's subordination to the vegetation, has become a principal cause of soil exhaustion and erosion in Africa, due to the shortening of the soil's resting period necessitated by increasing populations and the general tendency toward a more settled mode of life since European occupation ... The white man's burden in the future will be to come to terms with the soil and plant world, and it promises to be a heavier burden than coming to terms with the natives". "It seems as though mastery over tropical soils must be secured with the help of the ecologist rather than of the engineer ... the crying need ... is for more biological science". "Human dominance has its allotted period in the biological succession of a region, and we do not know enough about ecology ... to be able to skip the intermediate natural

stages between dominance by forest or savannah and dominance by man". ... " We have to learn not only the appropriate agricultural systems and operations, but also what type of society — tribal, feudal, despotic, democratic or otherwise can co-exist on the soil during its transition from a plant-dominated to a man-dominated type".

One solution of the African problem is segregation, by means of which native and European agriculture may each develop along distinct lines, but the need for soil conservation promises to be the factor which may decide whether this will be a successful solution, for erosion control requires unified treatment and co-ordinated land-utilization practices within each natural region. It is clear that the success of any scheme for permanent soil conservation in East Africa will depend on adjustments in the system of land tenure. Thus, the communal or tribal system fails where land is limited in extent, because soil exploitation soon results in erosion, but individual land ownership is not much better, since the greater the number of properties there are, "the more difficult it is to secure adequate co-operation between the landholders". "A system of land tenure analogous to mediaeval feudalism might well develop as a way out of the impasse created by soil erosion and the conflicting demands of the indigenous and exotic races on the land". The authors suggest, therefore, that "some system which will leave the responsibility for organising and the power to enforce soil conservation in the hands of a few, while the many do the work", may well be the future basis of land tenure in tropical Africa under European influence.

The political and social consequences of soil erosion in South Africa, having nearly reached catastropic imminence, are dealt with in a separate chapter (Chapter XXI) by Mr. Jacks, who comes to the conclusion that the best solution of the difficulties might be "the development of some system of land tenure whereby absolute control of all the land is vested in that class of the dominant race which shows itself capable of organizing for the perpetuation of conservative land-utilization", though it is not suggested that such a solution would be socially the most desirable.

In the concluding chapter, Mr. Jacks further discusses the significance of the paradoxical situation that has arisen in the world in which some of the most densely populated lands still have great reserves of fertility, whereas, in the new countries, rich lands have had to be abandoned to desert only a few decades after their settlement. Recovery by means of vast schemes for irrigating the semi-arid plains in Russia and North America may be feasible, and may induce a reversal of migration of populations back to the land. A dense population is the best insurance against erosion; for this reason, no great future is indicated for civilization in the tropics until the native races have reached a relatively advanced stage in social evolution.

In stressing the very important political and social consequences of land deterioration and soil erosion, the authors of this book have opened up the broader humanitarian aspects of agricultural science in world economy which no serious student of agriculture can afford to reject. (*Tropical Agriculture*, Vol. XVI, No. 10, pp. 223—225).

ABSTRACTS

Hormonal theory of plant development. (*Russian*). Chailakhyan M. K. Bull, Acad. Sci. U. S. S. R. S., 1937, pp. 198.

Results of numerous, chiefly photoperiodic, experiments carried out at the Timirjazev Institute of Plant Physiology, Academy of Science, Moscow, with many plants including several horticultural varieties such as Chrysanthemum indicum, Prunus persica, Diospyros Kaki, Citrus sinensis, Poncirus trifoliata, lupin, sunflower, etc., led the author to his theory, which may be shortly summarized as follows .— Prior to flowering a special flowering hormone called florigen is produced by the leaves. Long-day plants produce this hormone only under long day or permanent light conditions, short-day plants only under short-day conditions and day neutral plants under short-and long-day conditions. Grafting fertile short-day scions on long day stocks and vice versa proved that the flowering hormone is identical for all plants. The hypothetical florigen differs physiologically from growth substances or auxins. Whereas the latter are transported basipetally, florigen moves in all directions. Auxin content of plants increases with length of day regardless of their photo-periodicity, while florigen is formed only under certain conditions of photo-periodicity. In some plants the development of florigen depends also on temperature or vernalization. The bulletin is divided into 12 chapters dealing, after a general introduction (1) with sexual development (2) role of leaves (3) specificity of sexual development 4) and its physiological basis (5) formation (6) and transport of florigen (7) movement of florigen from one plant to another when transplanting (8) conditions of its formation (9) accumulation of florigen in leaves (10) florigen as sexual hormone of plants (11) conclusions (12) In this last chapter the practical application of the hormone theory in plant production is explained. By vernalization, photoperiodicity, transplanting and girdling, the concentration of the flowering hormone may be controlled and the flowering thus either forced or retarded, which is especially important in horticulture. Green manuring depressed the water table during growth. The increase in the water-holding capacity of the soil after several years' green manuring was statistically significant but practically unimportant. Loss of soil structure, however, noticeable in the clean cultivated plots, was reduced or removed by green manuring. The following possible explanations of the beneficial effect of organic matter on growth are discussed:— 1. the supply of essential nutrients in a readily assimilable form; 2. good effect on water-holding capacity and soil structure; 3. the supply of some minor element; 4. The supply of readily assimilable iron; 5. the increase in partial pressure of CO_2 within or above soil; 6. the formation of growth substance; 7. direction, nutrition or supply of growth substances through mycorrhizas; 8. influence on soil micro-organisms. (*Horticultural Abstracts* 9 (1939): 54).

Some effects of green manuring on citrus trees and on the soil. West, E. S., and Howard, A. *Bull. Coun. Sci. indust. Res. Aust.* 120,1938. pp. 36, bible. 41.

A thirteen year green manure experiment with citrus at Griffith, N. S. Wales, is here reported. The growth of a winter green crops, tick beans, increased growth and yield in Washington Navel and Valenica Late orange trees compared with clean cultivated trees. The growth of a summer green crop of cow peas at first caused a decrease but after 10 years an increase in growth and yield. Growth of lucerne offered too strong competition and resulted in decreased

growth and yield. There was a definite seasonal cycle of soil nitrate concentration in the tick bean and the clean cultivated plots, the former baving a higher annual mean nitrate content in the surface soil, the latter a higher content in the lower lying soils. Little decomposition took place if tick beans were ploughed in too early. The soil nitrate cycle was little affected by the presence, or absence of citrus. Ploughing in tick bean resulted in a rapid formation of ammonia.

Experiments on compost making. R. C. Wood, Emp. J. Exp. Agric., 1938 6, 350--68, bibl. 10.

The results of a number of experiments conducted by students of the Imperial College of Tropical Agriculture on compost-making are summarized. A note is added on the practical results of these experiments. The conclusions reached are as follows:—(1) It is not possible. even with standard material, to lay down a definite programme for composting. (2) The time available for decomposition affects the methods adopted, as the more rapidly decompostion is wanted to occur, the more expensive will the process become. (3) Of the factors controlling decomposition, aeration and moisture are the most important. (4) Correction for acidity has not been found necessary in the conditions obtaining. (5) The use of inoculating material has not been found necessary unless very rapid decomposition is desired. (6) Farm stock is most economically utilized for the decomposition of farm waste since the best treatment any compost material can have before it goes into the compost heap is under the feet of farm, stock, where it gets brussed and inoculated. (Author's summary except paragraph 6) (*in Hort. Abst.* 9 (1939) : 61).

Study on the vitality of old and new seeds of Mungo (Phaseolus aureus Roxb) —P. A. Rodngo—*Philippine Journal of Agriculture* Vol. 10·3, 285—Pl. 1.

To obtain information on the behaviour of old seeds as plant materials, the author undertook a study on the vitality of old and new seeds of Mungo. P. aureus. The old seeds were 11 years and 4 months old in stores and the new seed used as controls was taken from the crop of the old seed previously made. 100 seedlings of each kind were raised in pots and their behaviour noted. At maturity the plants were harvested and data on the number of pods produced weight of dry pods, weight of straw and weight of seeds per plant were taken. The results showed that there was a significant difference between the straw yeilds of the new and old seeds in favour of the latter. The old seeds gave greater pod yield and bean yield than the new seeds. The author believes that there is evidence of the existence of certain phenomena in seed in storage that are worthy of investigation; The seed would seem to require a certain degree of curing or seasoning before it is capable of attaining the peak of its vitality. This may vary with different crops and should be thoroughly studied so as to take advantage of its economic value.

EXTRACTS

Banana Research in Trinidad.

(From a lecture delivered by Sir Geoffrey Evans before the Royal Society of Arts).

I should now like to illustrate my theme further by giving a brief account of the investigations that are also being undertaken at the College on the banana. The inception of this research was due to the disquieting appearance of a disease which came into prominence about 1919, or just about the time that the College opened in Trinidad. Its spread threatened the vast plantations of bananas that had been established in Jamaica and the Central American Republics. I refer

to Panama Disease (Fusarium cubense). The botanists at the College began work on the problem about 1922, and started a collection of bananas with the object of ascertaining which, if any, varieties might prove to be immune or resistant.

The banana which is usually grown for commercial export is the Gros Michel, also known as the Jamaica banana, and it is this variety which has suffered so severely from disease. In 1926, the efforts of the plant breeders were supplemented by the addition of a plant pathologist and a plant physiologist, funds being provided by that excellent institution (now alas defunct), the Empire Marketing Board. The proposal was that the pathologist should make an exhaustive investigation into the pathogen itself while the physiological work should involve storage trials and a study of the ripening processes. It is curious to note how this research has developed. The pathologist made his exhaustive enquiry into the pathogen and came to the conclusion that the most effective and practical way of combating the Panama disease would be by breeding an immune variety. The same line of work was recommended later when an investigation came to be made into another serious disease that has quite recently appeared in the Western Hemisphere from the Far East, namely, the Sigatoka disease (Cercospora musa). This disease has been known in Fiji and the Ceylon area as a serious disease for twenty years or longer but no one knows how it crossed the seas to Surinam where it was first reported in 1932—33.

The Plant Breeders, headed by Professor E. E. Cheesman, meanwhile had made considerable progress. A number of varieties had been collected and a few of them had proved highly resistant to Panama disease. Practically all these, however (with the exception of the Cavendish types which do not set pollen or seed and are therefore valueless for breeding purposes), are small-fingered types containing many seeds and therefore valueless from the commercial point of view. On the other hand, the seeded varieties presented an immediate difficulty if they were to be used as parents in a breeding programme because the final product must be a seedless banana. It became obvious, therefore, that a knowledge of the genetical basis of sterility in the genus Musa was indicated and, as an outcome, a good deal of cytological investigation became necessary. As a result of this work it is now believed that the chief basis for sterility in bananas lies in the fact that the majority of the edible kinds of bananas such as Gros Michel are triploids, whereas most of the fully seeded types are diploids and have a chromosome number of 22. Hybrids from these two groups are often tetraploids and occasionally are found to have no seed. Hundreds of pollinations have been made, working on this theory and they number between 5,000 and 6,000 made in the last ten years. Even so, I should like to see a far larger number of seedlings raised as it would increase the chance of ultimate success, but existing facilities at the college do not at present render this extension of work a practical proposition. Many of these crosses are not successful, others are deliberately made in order to obtain more genetical knowledge of the behaviour of the genus. From the scientific point of view much valuable information has been obtained, and it is now possible to marshal the genus Musa into a few main groups of sub-genera and at the same time it has been found possible to disclose a number of synonyms that have crept into the nomenclature. For instance, the Gros Michel is variously called Jamaica banana in England the Piseng rajah in Malay, etc., and the Cavendish banana is indiscriminately known in other parts of the world as the Canary or Chinese in England, the Governor in the West Indies, the Kinguruve in Uganda, and so on.

With regard to the economic issue, two important results stand out clearly. The first is that many of these small-fruited seed-bearing species of wild bananas show remarkable resistance both to Panama disease (Fusarium cubense) and the

Leaf-Spot (Cercospora musa), and further that their hybrids descended from a commercial type such as the Gros Michel also show resistance.

The second point is that it should also be possible to breed a new variety with the necessary commercial attributes such as seedlessness, long fingers, good flavour and colour, the right shaped bunch for shipping and so on. The nearest approach to this is the new banana I. C. 2 which is the result of a cross between Gros Michel pollinated with M. acuminata, a wild small-fruited and seeded species from the Malayan region. The hybrid is very highly resistant both to Panama disease and Cercospora Leaf-spot, and its fruit is good flavoured and ripens up to a good yellow colour. The fingers although thick are slightly shorter than the Gros Michel and the bunches often contain one eccentric hand which makes it a little more difficult to handle on board ship. It is said not to throw such a high proportion of nine-hand or count bunches as the Gros Michel, but this is probably a matter for adequate field management, as owing to its wild parent it suckers more freely than the Gros Michel and is vegetatively more vigorous.

The result is promising, but the plant breeders both in Trinidad and Jamaica have arrived at the conclusion that, although M. acuminata is probably the most valuable parent so far tried, and the I. C. 2 represents the nearest attempt to a commercial banana so far raised nothing better is likely to accrue from this particular combination and that it is essential therefore to seek out a species which is even closer to the Gros Michel to serve as the wild parent. It is believed that Gros Michel originated in the dim and distant past somewhere in the Malaya Burmo-Siam triangle and that one or other of the parents from which it is descended may still occur-probably in a wild state-in that region. Through the assistance of the Colonial Office, the Royal Botanic Gardens, Kew, and the Agricultural Departments in this region, a search is now being promulgated and within the last few years a large number of new species and varieties has been assembled at Trinidad and Jamaica, and the search still continues. Kew plays an important part in this work. Until recently, corms or "bits" were collected from the East or Africa, and, in order to avoid the risk of introducing further diseases and pests into the Western Hemisphere, a quarantine station was erected in 1927 at the Royal Botanic Gardens where the plants are grown for several months before being sent on, after careful inspection, to the West Indies. We are particularly on the look-out for virus diseases such as "Bunchy Top," as we now know that a wild hybrid such as I. C. 2 which is highly resistant to Panama disease and Cercospora can be badly attacked by "Bunchy Top." In fact, Kew has already been instrumental in preventing two or three virus diseases from going to the West Indies. Recently as the investigation has swung over to wild species, seed alone has been dealt with. Banana seeds apparently do not preserve their viability for a long time and so the seeds collected in New Guinea or Burma or other parts of the East are first sent to Kew where, as a precaution, half the consignment is sown and the remainder sent on to the West Indies. It apparently sometimes happens that the seed loses its viability on the voyage between Kew and the West Indies. A large number of young banana plants raised from seed from Burma, New Guinea, Malaya and Assam etc., are being grown at the Kew at the present time.

Turning now to the other aspect of banana research, namely, the problem of ripening and transport, it is interesting to note how the work has developed. It is no use breeding a new banana unless the fruit will stand the long voyage to the European markets satisfactorily. All new types of possible commercial value have therefore to be tested for this purpose. Within the last ten years a well-equipped Low Temperature Research Station has been built at the Trinidad College and its findings have been of the greatest value so far as tropical fruits

are concerned. The immediate problem is the placing on the British market "a bigger and better banana." This involves fundamental research into the physiology of ripening, and a study of the respiration processes including problems of gas storage and the effect of humidity and the reasons for chilling.

The consumer in England does not realize that the banana he eats is really only about half grown. That, however is really the case because the "bunch" for the European trade is cut at the stage known as three-quarter full, and it is then hard and green. Under the present arrangements for shipping and transport this is the only possible way as otherwise a high proportion of fruit would ripen and decay on the voyage. The problem before the team of workers, consisting as it does of a pathalogist a physiologist and a bio-chemist, is to devise means of delaying the ripening processes so that the fruit may be left on the plant until it reaches a stage much nearer maturity before it is harvested.

(*The Journal of the Royal Society of Arts* 87 (1939) p p.342—348.

Gleanings.

Entomological Control of Lantana. The rapid spread of Lantana, a garden escape, in Northern Queensland, has brought it amongst the serious weed pests for which the Council for Scientific and Industrial Research, Australia, is seeking methods of control. A report published in Nature, Vol. 144, No. 3635, dated the 1st July 1939, states that in 1935 studies of *Teleconemia lantanoe* were commenced in Fiji, where this bug had been introduced from Mexico, its native home, by way of Hawaii. As it proved harmless to any Australian plants of economic importance, it was established under quarantine conditions in Canberra in 1936. The first liberations were made late in that year in the Northern Rivers area of New South Wales, and afterwards near Atherton in Queensland, and at Rockhampton. Disappointment followed, the bugs seemed to have disappeared, until in April of this year they were reported in the Atherton district in enormous numbers over an area of some twenty four acres. Leaves were falling from the Lantana bushes, flowers had been destroyed and in some instances up to two feet of the ends of branches had been killed as the result of the bug feeding on them. At Rockhampton also there are signs of establishment. Undue optimism is to be deprecated, and it is unlikely that similar success will be attained to that of *Caetoblastis* on prickly pear. It still remains to be seen whether *Teleconemia* can maintain itself in large numbers and whether continuous defoliation will destroy Lantana, nevertheless, the outlook is promising. *(The Indian Forester* Vol. LXV October 1939 No. 10).

What's in a Name Again? The importance of accurate classification and naming of forest insects is brought out in a recent Number of Indian Forest Records (Vol. V No. 3) which gives descriptions of 22 new species of beetle boring the seeds and fruits of forest trees. As a result of these studies it has been found that the so-called cardamom beetle which is regarded as a serious pest of cardamoms in Coorg, Mysore and Madras, actually breeds in the fruits of several forest trees, and only attacks cardamoms when in superfluous abundance. Damage to the crop can be prevented by not growing cardamoms in the vicinity of these dangerous trees or by keeping the ground clean of fallen fruits. None of the other species of seed and fruit beetles attack cardamoms. (*The Indian Forester* Vol. LXV October 1939 No. 10).

A Record for Viability of Seed. From seeds estimated to be between 300 and 500 years old, lotus plants are being grown to-day at the Field Museum of Nature History in Chicago. So far as can be ascertained, this represents the longest duration of delayed germination on record according to Dr. B. E. Dahlgren, chief

curator of botany. The oft-repeated story of the germination of wheat from the Egyptian pyramids is now well-known to be erroneous, Dr. Dahlgren says, the germinating grain having been derived from straw packing in which the Egyptian specimens were being shipped to Europe.

The lotus seeds had lain buried in a peat bed in Southern Manchuria through several centuries, and were received through the courtesy of the University of Chicago's department of botany. At the time these seeds were produced by nature perhaps before Columbus' first excursion into the New World there existed a small lake, about two square miles in area, covered with red lotus flowers identical with the species commonly found in Asia to-day.

Records show that this lake was drained some time between 160 and 250 years ago. Wind-drifted soil then gradually covered the area, and trees and other land vegetation began to grow. In this poplars measure four feet in, diameter, and trees that have been of aid in establishing the minimum age of the lotus seeds, thousands of which have been uncovered beneath the soil-bed in which the trees grow. The lower stratum containing the seeds is a peat bed that once was the bottom of the lake.

The seeds resemble small, dark, brown acorns. Their coats are hard as glass and highly polished. These outer covers are so impervious that the embryos inside have been protected through the centuries. (*Scientific American* Vol. 160, No. 5, May 1939). *The Indian Forester*, Vol. LAV, October 1939, No. 10).

Crop & Trade Reports.

Statistics—Cotton—1939-40—Intermediate Forecast Report. Pickings of the mungari or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. In Trichinopoly, the heavy rains in October and November are likely to reduce the yield of cotton to some extent. In Ramnad and Tinnevelly, the growth of the crop was affected by the poor and insufficient rains in December. The condition of the crop is generally satisfactory elsewhere in the province.

The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 22--9—0 for Cocanadas, Rs. 21—6—0 for Red and White Northerns, Rs. 24—9—0 for Westerns (mungari crop) Rs. 26—6—0 for Westerns (Jowari crop) Rs. 24—11—0 for Nadam, Rs. 35--11—0 for Coimbatore Cambodia, Rs. 32—9—0 for Southern Cambodia, Rs. 32—2—0 for Coimbatore Karunganni, Rs. 31—5—0 for Tinnevelly Karunganni, and Rs. 30—14—0 for Tinnevellies. When compared with the prices published in the last report, i. e., those which prevailed on 4th December 1939, these prices reveal a rise of about 19 per cent in the case of Coimbatore Karunganni, 17 per cent in the case of Coimbatore Cambodia, 12 per cent in the case of Westerns (Jowari crop), 11 per cent in the case of Tinnevellies, 9 per cent in the case of Nadam, 8 per cent in the case of Westerns (mungari crop), 7 per cent in the case of Cocanadas, 5 per cent in the case of Tinnevelly Karunganni and 3 per cent in the case of Southern Cambodia, the prices remaining stationary in the case of Northerns (red and white varieties)

Subject:—Statistics—Cotton—1939-40. Third Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 99 per cent of the total area under cotton in India.

The area under cotton up to the 25th November 1939 is estimated at 1,780,300 acres. When compared with the area of 1,505,400 acres estimated for the

corresponding period of last year, it reveals an increase of 18·3 per cent The increase in area is general in all the important cotton growing districts outside Guntur and is attributed to favourable rains and good prices at the sowing season. The area under irrigated cotton, mainly Cambodia, is estimated at 153,800 acres as against 129 400 acres in the corresponding period of last year thereby representing an increase of 18·9 per cent.

Pickings of the mungari or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. In the districts of East Godavari and Trichinopoly the crop has been affected to some extent by the heavy rains in October. Normal yields are expected in all the districts outside East Godavari and Trichinopoly. The seasonal factor for the Province as a whole works out to 100 per cent of the average as against 97 per cent in the corresponding period in the previous year. On this basis, the total yield is estimated at 366,800 bales of 400 lb. lint as against 294,200 bales of last year, thereby representing an increase of 24·7 per cent. The crop is young and it is too early to estimate the yield with accuracy.

The estimated area and yield according to varieties are given below :—

(Area in hundreds of acre, i. e., 00 being omitted ; Yield in hundreds of bales of 400 lb. lint, i. e. 00 being omitted).

Variety.	Area from 1st April to 25th November		Corresponding yield.	
	1939.	1938.	1939.	1938.
(1)	(2)	(3)	(4)	(5)
	Acs.	Acs.	Bales.	Bales.
Irrigated Cambodia ...	1,428	1,274	892	733
Dry Cambodia	1 578	1,596	336	321
Total, Cambodia ...	3,006	2,870	1,228	1,054
Uppam in the Central districts.	200	172	39	27
Nadam and Bourbon ...	221	25	12	2
Total, Salems ...	421	197	31	29
Tinnevellies* ...	4,290	2,700	1,073	639
White and red Northerns ...	1,670	1,630	209	200
Westerns ...	7,440	6,570	930	822
Warangal and Cocanadas ...	901	1,035	168	192
Chinnapatti short staple ...	75	52	9	6

*Includes Karunganni in Coimbatore. Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. as reported from important markets on 4th December 1939 was about Rs. 21—1—0 for Cocanadas, Rs. 21—6—0 for red and white Northerns, Rs. 22—13—0 for Westerns (mungari crop), Rs. 23—10—0 for Westerns (Jowari crop), Rs. 30—10—0 for Coimbatore Cambodia, Rs. 31—8—0 for Southern Cambodia, Rs. 27—0—0 for Coimbatore Karunganni, Rs. 29—11—0 for Tinnevelly Karunganni, Rs. 37—15—0 for Tinnevellies and Rs. 22—9—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those prevailed on 6th November 1939. these prices reveal a rise of about 50 per cent in the case of white Northerns and Westerns (Mungari crop), 37 per cent in the case of red Northerns and Western (Jowari crop), 33 per cent in the case of Southern Cambodia, 31 per cent in the case of Tinnevellies, 26 per cent in the case of Tinnevelly Karunganni, 25 per

cent in the case of Cocanadas. 16 per cent in the case of Coimbatore Cambodia, and Nadam, and 9 per cent in the case of Coimbatore Karunganni.

Statistics—Paddy—1939-40. Intermediate Report. The main crop of paddy has been or is being harvested in parts of the Circars, the Deccan, Nellore, the Central districts, Taniore and Madura. The yield is reported to be normal in the Deccan (Ananthapur excepted), Nellore, Salem and Coimbatore, and below normal in the other districts.

The crop has been affected by drought to some extent in parts of Chinglepet, Chittoor, Ramnad and Tinnevelly and by insect pests in parts of North Arcot and Tanjore. The condition of the crop is generally satisfactory in the other districts.

The wholesale prices of paddy, second sort, per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 3—1—0 in Chittoor, Rs. 3—0—0 in Madura, Rs. 2—12—0 in Tinnevelly and Virudhunagar, Rs. 2—11—0 in Rajahmundry, Rs 2—10-0 in Vizianagaram and Vellore, Rs. 2—8—0 in Cocanada and Kumbakonam, Rs 2—7—0 in Ellore, and Bezwada, Rs. 2—6—0 in Guntur, Hindupur and Trichinopoly, Rs. 2—5—0 in Masulipatam and Cuddalore, Rs. 2—4—0 in Anantapur and Rs. 2-0-0 in Nagapatam and Conjeeveram. When compared with the prices published in the last report, i. e., those which prevailed on 11th December 1939, these prices reveal a fall of about 17 per cent in Trichinopoly, 14 per cent in Masulipatam, 13 per cent. in Vellore, 12 per cent in Guntur, 11 per cent in Nagapatam, 9 per cent in Bezwada, and Conjeeveram. 7 per cent in Hindupur, 4 per cent in Rajahmundry and Chittoor, and 2 per cent in Cocanada, Virudhunagar and Tinnevelly, the prices remaining stationary in Vizianagaram, Anantapur, Cuddalore, Kumbakonam and Madura.

Subject—Statistics—Paddy—1939-40—Second Forecast Report. The average of the areas under paddy in the Madras Province during the five years ending 1937—38 has represented 13·4 per cent of the total area under paddy in India.

The area sown with paddy up to 25th November 1939 is estimated at 8,486,000 acres. When compared with the area of 8,980,000 acres estimated for the corresponding period of the previous year, it reveals a decrease of 5·5 per cent.

The decrease in area occurs in all districts outside Guntur, Kurnool, Bellary, Salem, Tanjore and the Nilgiris and is due to the late receipt of rains at the sowing time.

The first crop has been generally harvested throughout the Province. Yields below normal have been reported from the Circars and Tanjore. The yield is expected to be normal in the other districts. The crop has been affected to some extent by the heavy rains and floods in November 1939 in parts of the districts of East Godavari, West Godavari, Kistna and Tanjore.

The seasonal factor for the Province as a whole works out at 97 per cent of the average as against 90 per cent in the corresponding period of the previous year.

The wholesale price of paddy second sort, per imperial maund of 82 2/7 lbs. as reported from important markets on 11th December 1939 was Rs. 3—3—0 in Chittoor, Rs. 3—0—0 in Vellore and Madura, Rs. 2—14—0 in Trichinopoly, Rs. 2—13—0 in Rajahmundry, Tinnevelly and Virudhanagar, Rs. 2—11—0 in Bezwada. Masulipatam and Guntur, Rs 2—10—0 Vizianagaram, Rs. 2—9—0 in Cocanada and Hindupur, Rs. 2—8—0 in Kumbakonam, Rs. 2—5—0 in Cuddalore, Rs. 2—4—0 in Anantapur and Negapatam and Rs. 2—3—0 in Conjeevaram. When compared with the prices published in the last report, i. e., those which prevailed on 6th November 1939, the prices reveal a rise of 17 per cent in Hindupur,

16 per cent in Chittoor, 15 per cent in Anantapur, 10 per cent in Tinnevelly, 9 per cent in Cuddalore, 8 per cent in Masulipatam, 7 per cent in Rajahmundry 5 per cent in Bezwada, Guntur and Virudhunagar, 4 per cent in Vellore, 3 per cent in Cocanada, and 2 per cent in Trichinopoly and a fall of 10 per cent in Conjeeveram and 2 per cent in Madura, the prices remaining stationary in Vizianagaram, Kumbakonam and Negapatam.

Statistics—Crop—Groundnut—1939—Fourth or final report. The average of the areas under groundnut in the Madras Province during the five years ending 1937–38 has represented 50·1 per cent of the total area under groundnut in India.

The area sown with groundnut in the Province in 1939 is estimated at 3,534,200 acres. When compared with the corresponding estimate of 3,835,300 acres for the previous year and the actual area of 3,771,588 acres according to the season and crop report of the previous year, the present estimate reveals a decrease of 7·9 per cent and 6·3 per cent respectively. The estimated area for this year exceeds the average area of 3,075,230 acres by 14·9 per cent.

The decrease in area is general outside Vizagapatam, Guntur, Bellary, Anantapur and Malabar. The variations are marked in Kistna (–32,600 acres), Bellary (plus 94,100 acres), South Arcot (–58 700 acres), North Arcot (–53,300 acres, Coimbatore (–32,400 acres), Madura (–39,300) acres and Ramnad (–24 600 acres). The area in the South fell from 282,300 acres in 1938—39 to 199,000 acres) in the current year i. e., by 29·5 per cent. The area estimated for Vizagapatam is the highest reported in recent years.

The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop in Kistna district was affected by the advent of heavy rains at the time of ripening; the unprecedented rains in Tanjore district in November 1939 were also responsible for a large reduction in the yield. The crop was affected by drought in most other districts apart from an attack of insect pests in parts of North Arcot, Salem and Tanjore. The yield is expected to be below normal in all districts except Kurnool and Bellary where a normal yield is expected. The yield is estimated to be low in Tanjore (50 per cent), South Arcot (70 per cent) and North Arcot (75 per cent). The seasonal factor for the Province as a whole works out to 69 per cent of the average as against 86 per cent in the previous year according to the season and crop report. On this basis the yield is expected to be 1,576,500 tons of unshelled nuts as against, 1,613,000 tons in the previous year, a decrease of 2·3 per cent. The average yield an year is estimated at 1,540,280 tons.

The wholesale price of groundnut (shelled) per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 5–2–0 in Cuddalore, Rs. 4–12–0 in Vizagapatam, Rs. 4–10–0 in Vizianagaram, Guntur and Tadpatri, Rs. 4–8–0 in Adoni, Rs. 4–0–0 in Bellary, Rs. 4–3–0 in Nandyal; Cuddapah, Vellur, Ananthapur and Hindupur and Rs. 3–15–0 in Coimbatore. When compared with the prices published in the last report, i. e.. those which prevailed on 6th November 1939, these prices reveal a rise of approximately 14 per cent in Adoni, 8 per cent in Bellary and Cuddapah, 5 per cent in Nandyal and Hindupur and a fall of approximately 4 per cent in Tadpatri, 3 per cent in Guntur and one per cent in Vizagapatam, the prices remaining stationary in Vizianagaram, Cuddalore, Coimbatore and Anantapur.

Statistics—Pepper—1939—Final Report. The area under pepper in 1939 in the districts of Malabar and South Kanara is estimated at 104, 600 acres (96,000 acres in Malabar and 8,600 acres in South Kanara) as against the final area of 102,819

acres (94,018 acres in Malabar and 8,801 acres in South Kanara) in the previous year.

The harvesting of the crop is reported to have just commenced. The seasonal factor in both the districts is estimated at 105 per cent of the average as against 80 per cent in the previous year. On this basis, the yield is estimated at 10,550 tons (9,680 tons in Malabar and 870 tons in south Kanara) as against 7,900 tons (7,220 tons in Malabar and 680 tons in South Kanara) in the previous year.

The wholesale price of pepper per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 11—10—0 in Calicut, Rs. 11—12—0 in Tellicherry, and Rs. 13—1—0 in Mangalore. When compared with the prices published in the last report, i. e., those which prevailed on 4th September 1939, these prices reveal a rise of 19 per cent in Mangalore, 8 per cent in Tellicherry and 2 per cent in Calicut.

Statistics—Ginger—1939—Final Report. The area under ginger in 1939 is estimated at 11,300 acres in Malabar and 700 acres in South Kanara as against the actual area of 11,330 acres in Malabar and 713 acres in South Kanara in the previous year.

The crop is being harvested in parts and the yield ia esiimated to be normal in both the districts. On this basis, the total yield is expected to be 4,290 tons of dry ginger 4,040 tons in Malabar and 250 tons in South Kanara as against 3,810 tons in the previous year (3,630 tons in Malabar and 180 tons in South Kanara).

Statistics—Crop—Gingelly—1939-40—Third Report. The average of the areas under gingelly in the Madras Province during the five years ending 1937-38 has represented 15·6 per cent. of the total area under gingelly in India.

The area sown with gingelly up to 25th December 1939 is estimated at 601,900 acres. When compared with the area of 575,300 acres estimated for the corresponding period of last year, it reveals an increase of 4·6 per cent. The area estimated for Salem and Coimbatore is the highest reported in recent years.

The estimated area is the same as that of last year in Tanjore and South Kanara; an increase in area is revealed in Anantapur, Chingleput, South Arcot North Arcot, Salem, Coimbatore, Ramnad and Malabar and it is partly counterbalanced by a decrease in area in the rest of the Province. The variations are marked in East Godavari (–25,000 acres) West Godavari)–20,000 acres), Chingleput (plus 14,700 acres), South Arcot (plus 10,000 acres), North Arcot (plus 26,000 acres), Salem (plus 44,000 acres), Coimbatore (plus 10,000 acres) and Trichinopoly (–19,500 acres).

The main crop has been harvested except in the South. The yield was below normal except in Kurnool, Salem and South Kanara where it was reported to be normal.

The seasonal factor for the Province works out to 87 per cent. of the average as against 84 per cent for the corresponding period of last year. On this basis, the yield is estimated at 69,400 tons as against 65,400 tons for the corresponding period of last year, an increase of 6·1 per cent.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 7-8-0 in Cocanada, Rs. 7—6—0 in Vizagapatam, Rs. 6—8—0 in Vizianagaram, Rs. 6—7—0, in Ellore, Rs. 6—4—0 in Rajahmundry, Rs. 6—3—0 in Tuticorin. Rs. 6—0—0 in Tinnevelly, Rs. 5—15—0 in Cuddalore and Trichinopoly and Rs 5—7—0 in Salem. When compared with the prices published in the last report i. e., those which prevailed on 6th November 1939, these prices reveal a rise of approximately 16 per cent. in Vizagapatam and Ellore 15 per cent. in Cocanada, 10 per cent. in

Rajahmundry, 9 per cent. in Tuticorin and 4 per cent. in Cuddalore and a fall of approximately 6 per cent. in Tinnevelly and 2 per cent. in Trichinopoly, the prices remaining stationary in Vizianagaram and Salem.

Statistics--Crop—Castor—1939--First or final report.— The average of the areas under castor in the Madras Province during the five years ending 1937--38 has represented 16·9 per cent of the total area under castor in India.

2. The area under castor in the Madras Province up to 25th November 1939 is estimated at 272,600 acres. When compared with the area of 256,000 acres estimated during the corresponding period of last year, it reveals an increase of 6·5 per cent. The estimate of last year was below the actual area of 270,278 acres by 5·3 per cent.

3. An increase in area is estimated in Bellary, Anantapur and Chittoor partly counterbalanced by an estimated decrease in area in the other districts. The increase is marked in Anantapur (plus 14,500 acres).

4. The yield is expected to be normal in all districts except Chittoor where it is estimated to be slightly below normal. The seasonal factor for the Province as a whole is estimated to be 100 per cent of the normal On this basis, the yield is estimated at 26,800 tons as against 25,700 tons estimated for the corresponding period of last year and 22,410 tons estimated in the season and crop report of last year.

5. The wholesale price of castor seed per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 18th December 1939 was Rs. 6—14—0 in Nandyal, Rs. 5—8—0 in Vizianagaram and Bellary, Rs. 5—6—0 in Salem, Rs. 5—0—0 in Cuddapah, Rs. 4—10—0 in Hindupur and Rs. 4—8—0 in Anantapur. When compared with the prices reported in the previous year i. e. those which prevailed on 19th December 1938, these prices reveal a rise of approximately 35 per cent in Bellary, 31 per cent in Nandyal, 28 per cent in Salem, 19 per cent in Vizianagaram and 12 per cent in Hindupur and a fall of approximately 2 per cent in Cuddapah, the price remaining stationary in Anantapur. (*From the Director of Industries, Madras.*)

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1939 to 12th January 1940 amounted to 486,012 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 536,138 bales. 426,037 bales mainly of pressed cotton were received at spinning mills and 184,616 bales were exported by sea while 144,362 bales were imported by sea mainly from Karachi aud Bombay.

(*From the Director of Agriculture, Madras.*)

Market Reports

TIRUVOTTIUR MILCH CATTLE MARKET

Market Report No. 24.

Madras, Friday the 15th December 1939.

The arrivals of milch cows continue to be heavy while those of buffaloes have decreased. There is a marked increase of the buying activity at the market as a result of which prices of especially milch cows have improved.

The stock movements during the week were as follows :—

	Stock at Commencement.	Arrival during the week.	Sale during the week.	Balance.
Cows-Ongole	140	158	153	145
Buffaloes-country	150	128	138	150

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	95
	3—4 „ „	95	120
3rd and 4th calving	2—3 „ „	70	80
	3—4 „ „	80	105
Buffaloes-country			
1st and 2nd calving	2—3 „ „	55	75
	3—4 „ „	75	100
3rd and 4th calving	2—3 „ „	50	65
	3—4 „ „	65	80
Others			
Cows-cross-bred		130	160

Market Report No. 25.

Madras, Friday the 22nd December 1939.

Arrivals of cows and buffaloes have slightly declined and the sales are not heavy. The slightly increased prices that prevailed last week are continuing.

The stock movements during the week were as follows :—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance.
Cows-Ongole	145	132	97	180
Buffaloes-country	160	116	96	170

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 „ „	95	120
3rd and 4th calving	2—3 „ „	70	80
	3—4 „ „	80	105
Buffaloes-country			
1st and 2nd calving	2—3 „ „	55	75
	3—4 „ „	75	100
3rd and 4th calving	2—3 „ „	50	65
	3—4 „ „	65	80
Others			
Cows-cross-bred		130	180

Market Report No. 26.

Madras, Friday the 29th December 1939.

Arrivals of cows from the Ongole tract have been heavy during the week and there is a good stock of cows at the market. The prices of both cows and buffaloes tend to decrease slightly.

The stock movements during the week were as follows :--

	Stock at Commencement	Arrivals during the week.	Sales during the week.	
Cows-Ongole	180	189	169	200
Buffaloes-country.	170	97	106	161

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 " "	90	120
3rd and 4th calving	2—3 " "	70	80
		80	100
Buffaloes-country			
1st and 2nd calving	2—3 " "	55	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others.			
Cows-cross-bred.		130	180

Market Report No. 1 of 1940.

Madras, Friday the 5th January 1940.

Arrivals of cows were low during the week while those of buffaloes have increased. There was a good trade in country buffaloes. The prices are steady when compared with those of last week.

The stock movements during the week were as follows :—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance at end.
Cows-Ongole	200	80	105	175
Buffaloes-country.	161	142	155	150

Prices.

Age.	Milk yield.	Prices ranging. From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures.	80	90
	3—4 " "	90	120
3rd and 4th calving	2—2 " "	70	80
	3—4 " "	80	100
Buffaloes-country			
1st and 2nd calving	2—3 " "	55	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others			
Cows-cross-bred		130	180

Market Report No. 2 of 1940.

Madras, Friday the 12th January 1940.

The arrivals of buffaloes have gone down as compared to those of last week. There is a slackening of business towards the end of the week due to the impending Pongal festival. Prices are steady.

The stock movements were as follows :—

	Stock at commencement.	Arrivals during the week.	Sales during the week.	Balance at end.
Cows-Ongole	175	105	130	150
Buffaloes-country	150	79	120	109

Prices.

Age.	Milk yield	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—3 ,, ,,	60	80
Cows-cross-bred		120	180

(Madras measure of milk = 4 lbs.)

BIOLOGICAL ABSTRACTS

(From the Office of the Editor-in-Chief, Biological Abstracts.)

Men engaged in research in medicine, public health, ecology, agriculture, forestry, botany or zoology, geography, and other fields, will welcome the announcement that *Biological Abstracts* is undertaking a more complete abstracting and segregation of the current research literature in bioclimatology and biometeorology. The section *Bioclimatology-Biometeorology* will appear within the section *Ecology in Biological Abstracts*, and will be under the editorship of Mr. Robert G. Stone of the Blue Hill Observatory, Harvard University.

The increasing interest in climatic and meteorological factors in their relation to biology, medicine, and agriculture is one of the significant trends of modern science. Ecologists have long appreciated, the importance of temperature, humidity, radiation, barometric pressure, wind movement, and meteorological factors generally, as important factors in controlling the distribution and abundance of animals and plants. Foresters, horticulturists, and entomologists have likewise been concerned with the interrelationships of climatic and meteorological factors to the organisms with which they work. The developments of air conditioning and aviation have lately brought other important research groups into the field resulting in an increasing amount of research. This is often the work of individuals and groups not now in effective contact with biologists and frequently appears in periodicals not commonly consulted by biologists.

In all civilised nations diverse research groups have sprung into being which, though they often devote much attention to the same fundamental natural forces, still work in practical isolation from each other, with a different background of training, and associations, belonging to different societies meeting at different times and places, publishing in different journals, reading different literature, investigating different types of things. These groups, however, are beginning to apply common ideas and common methods to the study of situations that are basically similar. For example, techniques and concepts derived from a study of the influence of weather factors on the spread of influenza or the common cold are likely to have a very high transfer value as applied to the study of the spread

or survival of plant disease or economic insects. Conversely, it should be possible for research workers in the field of public health to make use of many findings of the entomologists, forestors, ecologists, plant pathologists, and other biological groups.

The abstracting journals of broad scope, like Biological Abstracts, are admirably suited to the sort of synthesis of fundamental knowledge that this situation demands. Inaugurating this service Biological Abstracts will be fulfilling one of the functions for which it was originally intended: that of providing an effective tool for research workers by co-ordinating the literature of border-line fields.

Under the sectional publication plan this material will be found, at present, not only in Section A, *Abstracts of general Biology*, but also under Section B' *Abstracts of Experimental Animal Biology*, Section D. *Abstracts of Plant Sciences.* and Section E, *Abstracts of Animal Sciences.*

College News and Notes.

Students' Corner. Students' Club—*Literary Activities*:— Dr. Jesudasan of Tirupattur Ashram delivered a lecture on "Students and Villagers" on 8—1—40 in the premises of the Students' Club. Dr. Paton, a co-worker with Dr. Jesudasan also gave a short talk on his experiences in rural India. Mr. H. Shiva Rao, the vice-President of the club presided on the occasion.

Under the chairmanship of Mr. R. C. Broadfoot, Principal of the college, Dr. W. Burns, Agricultural Commissioner with the Government of India addressed a gathering of students and officers on the estate on 16—1—40 at 6 p. m. in the Freeman Hall. In the course of his lecture, Dr. Burns stressed on the need for improvement on every little phase and item of agricultural operations.

Sir T. Vijayaraghavacharya, member of the Indian Central Cotton Committee, addressed the students on 19—1—40 with Mr. Roger Thomas, B. Sc. a former Deputy Director of Agriculture of the Madras Agriculture Department and Member I. C. C. C. in the chair. Sir T. Vijayaraghavacharya treated the audience to a most humorous and thought-inspiring address.

Students' tour. The students of B. Sc. II were taken on an agricultural tour to the West Coast from the 3rd to the 12th January. They visited the Agricultural Research Stations at Kasargode, Taliparamba and Pattambi, besides several private farms and demonstration centres. The party was accompanied by Messrs. P. A. Venkateshwaran and M. Kalimuthu, Teaching Assistants in Agriculture.

Selection Examination results. The College Board met on the 9th January 40 to select students of B. Sc. I, II and III for the University examination to be held in April next. One student of B. Sc. I was detained by the board.

Games-Interclass match for the Victory cup. In the club day cricket fixture, class II. In Football, class III lost to class I. In the Inter-tutorial cricket match C. R. Srinivasa Iyengar's wards won over Sri P. V. Ramiah's wards.

Madras University Inter-collegiate finals. This match was played at Madras between the Agricultural College Eleven and Medical College at the latter's grounds. The match ended in a defeat for our team. The college eleven is however to be congratulated for reaching the finals.

Honey Week. The Honey Week Celebration was inaugurated by P. M. Khareghat Esq. C. I. E., I. C. S., Vice President of the Imp. Council of Agricultural research on 18—1—40 at 4-30 P. M. in the premises of the Insectary,

A distinguished gathering was present on the occasion. The Exhibition connected with the Honey Week was held from the 18th to 25th January 40.

Indian Central Cotton Committee. At the invitation of the Government of Madras, the winter session of the Indian Central Cotton Committee was held at Coimbatore. The meetings of the committee took place at the old Forest College buildings, Coimbatore between the 15th and 20th of January 40. The members of the committee were treated to a number of tea-parties, lunches and dinners Most of the parties were held in the Freeman Hall of the Agricultural College. The Government of Madras was 'At Home' to the members of the committee at a delightful luncheon party held on the 20th of January in the Freeman Hall. Most of the members of the committee visited the Agricultural College and Research Institute and the Cotton Breeding Station.

Foot and mouth Disease. The restrictions imposed on the movement of vehicular traffic and entry into the Central Farm, as a result of the alarm caused by the serious outbreak of foot and mouth disease in the vicinity of the estate, have been lifted with effect from the 10th of January 40. It is gratifying to note that no animal in the central farm has been a victim to this disease during this period, owing to the efficient control measures taken.

Congress House Exhibition at Madras. As usual the agricultural Department participated in this annual exhibition, which unfortunately was the scene of a very disastrous fire. The department, in common with others, sustained serious losses in the form of several valuable exhibits. The loss would have been enormous but for the courageous stand of the departmental officers on duty in the stall, who not only saved a large amount of departmental property, at great risk to their lives but extended free help to enable many visitors to escape to places of safety. The conduct of the Officers on duty at the stalls on the ill fated day has been highly commended.

Vaccination of residents on the estate: As a result of smallpox scare in the neighbourhood, vaccination of estate residents—particularly children, was arranged on the 4th January.

Personal. Mr. C. Ramaswamy of the Agricultural College who was selected to play for the Indians in the presidency match against the Europeans scored a brilliant century in the first innings. While we heartily congratulate him for his splendid performance in the fixture, we note with regret his recent announcement of retirement from first class matches in future.

It is understood that Dr. R. Sankaran, M. A., Ph. D., Cotton Assistant, has been offered the post of Cotton Botanist, Sind. We offer our felicitations to him.

We are glad to note that Mr. T. Krishnamurthy, B. Sc., Ag. an old student of this college has been appointed Agronomist at Pusa.

We congratulate Mr. P. A Venkateshwaran, B. A., B. Sc. Ag., Teaching Assistant in Agriculture, on his appointment as the Warden of the Agricultural College Hostel. This is the first time that a non-gazetted officer is appointed to this post.

Visitors. Rao Bahadur B. Viswanath, Director of the Imperial Institute of Agriculture, New Delhi. visited the Cane Breeding Station on the 4th January. Dr. Chona, the Sugarcane Plant Pathologist, and Dr. Lall the Entomologist, from the Imperial Institute also visited the Cane Breeding Station and the Agricultural College Research Institute between 4th and 6th January. Dr. J. S. Patel, formerly Oil Seeds Specialist, Coimbatore and now Jute Specialist, Dacca visited the Research Institute on 29—12—39.

A batch of 100 students. from Perianayakanpalayam, Ramakrishna Vidyalaya, accompanied by their headmaster visited the Agricultural College and Central Farm on 15—1—40.

Mr. P. H. Rama Reddy, Director of Agriculture, Madras, stayed in the estate from the 11th to 22nd January, in connection with the meetings of the Indian Central Cotton Committee.

Obituary.

We very much regret to record the death of Sri A. P. Balakrishnan Nayar, B. Sc. Ag., Agricultural Demonstrator, Omalur at an early age of 38 years, at his native place Paruthipulli in Palghat Taluq on 22—12—39. Mr. Nayar was born on 22nd April 1902 and was appointed in the department on 19th July 1926. He was an enthusiastic and energetic officer devoted to his duty and a man of pious disposition. We offer our condolences to the bereaved family.

Woodhouse Memorial Prize.

In Memory of Mr. E. J. Woodhouse, Late Economic Botanist and Principal of Sabour Agricultural College who was killed in action in France in 1917, a biennial prize in the form of a Silver Medal and books of a combined value of Rs. 100. will be awarded to the writer of the best essay on a subject to be selected from the list noted below. The length of essay should not exceed 4000 words.

The competition is open to graduates of Indian Universities and to Diploma holders and Licentiates of recognized Agricultural College in India who are not more than 30 years of age on the date of submission of their essays.

Papers should be forwarded to the Director of Agriculture, Bihar, Patna, before the 26th June, 1940.

Failing papers of sufficient merit, no award will made. Essays must be typewritten on one side of paper only.

for Director of Agriculture, Bihar.

Subjects for essay.

1. Importance of Physiological studies in Modern Plant breeding.
2. Dominant species as an Index of Soil Texture.
3. Modern methods of inducing mutations and polyploidy and their value for Indian Agriculture.
4. Problems of wheat improvement in India.

Science, Vol. 90, No. 2334, 22nd September 1939.

Chromosomes in growing grain have their numbers doubled when the seed is treated with a fungicide distributed under the trade name "Granosan", Dr. Dontcho Kostoff, of the Institute of Genetics at Moscow, has discovered. Seeds treated with the compound are not attacked by fungi, whereas seeds treated with colchicine are frequently killed by these parasitic forms.

Weather Review—DECEMBER 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	1·5	+0·8	32·5
	Calingapatam	0 0	−0·7	28·9
	Vizagapatam	0·3	−0·4	32·9
	Anakapalli*	0·8	+0·6	40·3
	Samalkota*			
	Maruteru*	0·0	−0·5	50·4
	Cocanada	0·0	−0·9	59·7
	Masulipatam	0·0	−0·9	47·7
	Guntur*	0·0	−0·1	34·6
Ceded Dists.	Kurnool	0·0	−0·2	20·0
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·0	−0·1	21·3
	Siruguppa*	0·0	−0·2	21·3
	Bellary	0·0	−0·1	18·5
	Anantapur	0·0	−0·3	28·8
	Rentachintala	0·0		28·2
	Cuddapah	0·1	−0·8	26·6
	Anantharaju-pet*	0·4	−1·6	31·6
Carnatic	Nellore	0·3	−2·9	37·3
	Madras	0·9	−4·9	33·7
	Palur*	0·2	−7·3	53·6
	Tindivanam*	0·2	−4·3	40·5
	Cuddalore	0·7	−6·5	67·2
Central	Vellore	0·3	−2·4	40·2
	Salem	0·2	−0·8	48 1
	Coimbatore	0·0	−0·2	25·0
	Coimbatore A. C. & R. I.*	0 0	−1 5	26·7
	Trichinopoly	1·0	−1·6	52·1

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·3	- 11·1	55·6
	Aduthurai*	0 5	−8·1	56·2
	Madura	0·0	−1·8	36·2
	Pamban	0·6	−6·9	29·4
	Koilpatti*			
	Palamkottah	0·3	−3·7	17·8
West Coast	Trivandrum	0·5	0·0	71·6
	Cochin	0·1	−1·6	133·8
	Calicut	0·0	−1·1	115·3
	Pattambi*	0·1	−0·7	97·2
	Taliparamba*			
	Kasargode*	0·0	−0·9	113·8
	Nileshwar*	0·0	−0·7	121·3
	Mangalore	0·0	−0·5	116·3
Mysore and Coorg	Chitaldrug	0·0	−0·3	34·1
	Bangalore	0·0	−0·5	35·2
	Mysore	0·0	−0·4	30·0
	Mercara	0·0	−0·7	104·7
Hills	Kodaikanal	0·5	−3·9	70·1
	Coonoor			
	Ootacamund*	0·0	−1·21	67·60
	Nanjanad*	0·0	−1·8	52·0

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Weather Review for December 1939. Weather has been dry over the country except for a few light local showers in parts of South East Madras, Malabar and N. Madras Coast. On the 4th a cyclonic storm formed near Lat. 10—11 N. and long. 92°—93° E. moved in a North Westerly direction to Lat. 19° N. and Long. 88°E. on the 9th and became unimportant on the 10th. This storm caused a few falls of rains in Orissa, The rainfall was in very large defect

Skies were moderately clouded in the Madras Presidency and clear or lightly clouded elsewhere. The humidity was in excess locally in Malabar, Hyderabad and North Madras Coast and in defect in the Bombay Deccan, South Hyderabad and Konkan,

The maximum temperature were above normal in Konkan and North Madras Coast, and below normal in Mysore and Madras Deccan.

The minimum temperatures were above normal in Mysore and South East Madras and below normal in the Bombay Deccan and North Hyderbad.

Weather Report for the Research Institute Observatory.

Report No. 12/39.

Absolute maximum in shade	...	87·0°F.
Absolute minimum in shade	...	56·2°F.
Mean maximum in shade	...	83·8°F.
Departure from normal	...	Nil.
Mean minimum in shade	...	64·9°F.
Departure from normal	...	−0·2°F.
Total rainfall	...	Nil.
Departure from normal	...	−1·5″
Heaviest fall in 24 hours	...	Nil.
Total number of rainy days	...	Nil.
Mean daily wind velocity	...	1 m. p. h.
Departure from normal	...	−2·0 m. p. h.
Mean humidity at 8 hours	...	75%
Departure from normal	...	−3·8%

Summary. Dry fine weather prevailed during the month with a slight drizzle on the 13th. The rainfall was nil and 1·5″ below normal. The day temperatures were normal and the night temperatures were slightly below normal. Skies were moderately clouded and the humidity was in defect. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Leave.

Name of Officers.	Period of leave.
Sri. B. Ramiah, Dy. D. A. (on leave)	Extension of l. a. p. on m. c. for 4 months and leave with m. c. on half average pay for 2 months from 1—12—39.

Subordinate Services.

1. Appointments.

Sri. M. Achanna Sastri, B. Sc. Ag., Fieldman, Agricultural Research Station, Samalkota—to officiate as Upper Subordinate, Agricultural Section till further orders vice Sri. K. Gurmurthi on other duty and is posted to I Circle.

Sri. K. Dorai Raji, B. Sc. Ag., Fieldman, Agricultural Research Station, Pattambi—to officiate as Assistant in Chemistry Section, Coimbatore till further orders vice Sri. K. Govindan Nayar on leave.

Sri. M. Subrahmanya Chetty, Officiating Farm Manager, Agricultural Research Station, Guntur on return from leave on 3rd January 1940 is appointed to officiate as Assistant in Cotton till further orders Vice Sri. R. Balasubrahmanya Ayyar on leave.

2. Promotions.

The following provisionally substantive promotions of Upper Subordinates in the Agricultural Section are ordered with effect from 15th August 1939:—

From IV Grade Rs. 120—10—170 to III Grade Rs. 200.

(i) Sri. M. P. Gourisankara Ayyar, Permanent Upper Subordinate, Agricultural Section IV Grade to III Grade (*Provisional*)

(ii) Sri. P. Abhishekanatham Pillai, Permanent Upper Subordinate, Agricultural Section IV Grade to III Grade (*Provisional*)

(iii) Sri. F. G. Muthuswami Ayyar, Permanent Upper Subordinate, Agricultural Section, IV Grade to III Grade (*Provisional*)

From V Grade Rs. 85—5—120—to IV Grade Rs. 120—10—170.

(i) Sri. N. C. Tirumalai Acharya, Permanent Upper Subordinate, Agricultural Section, V Grade to IV Grade (*Provisional*)

(ii) Sri. P. A. Venkateswara Ayyar, Permanent Upper Subordinate, Agricultural Section V Grade to IV Grade (*Provisional*)

(iii) Sri. S. S. Katchapeswara Ayyar, Permanent Upper Subordinate, Agricultural Section V Grade to IV Grade (*Provisional*)

Transfers.

Name of officers	From	To
Sri C. Krishnamurthy,	A. R. S., Anakapalli,	A. D., Nellore District.
„ N. C. Tirumalai Acharya,	F. M., C. B. S., Coimbatore,	A. D., Srivilliputhur.
„ P. S. Krishnamurthi,	Asst. in Entomology, Bellary Division,	Nellore Division.
„ M. Jeevan Rao,	F. M., F. R. S., Kodur,	A. D., Sidhout.
„ A. Raghavan,	A D., Sidhout.	F. M., A. R. S., Nandyal.
„ S. Ponnuswami Naidu,	Asst. A. D., Ambasamudram,	A. D., Rapur, Nellore Division.
„ J. V. V. Suryanarayana.	A. D., Rayachoti.	A. D., Cuddapah.
„ K. Ramanujachari,	F. M., A. R. S., Nandyal,	A. D., Atmakur.
„ S. Mahadeva Ayyar,	A. D., Kodaikanal,	Pomological Station, Coonoor,
Janab P. P. Syed Muhamad Sahib,	A. D. (on leave),	A. D., Omalur.
Sri M. Somayya.	A, D., Yellamanchilli.	A. D., Tuni.

Leave.

Name of officers.	Period of leave.
Sri V. T. Subbiah Mudaliar, Upper Subordinate, Agricultural Section.	L. a. p. for 3 months from 3—1—40.
„ P. Seetharamiah, Botany Assistant. A. R. S., Anakapalli,	L. a. p. for 2 months from 12—1—40.
„ B. Shiva Rao, A. D., Tuni,	L. a. p. for 2 months from 1—2—40.
„ K. Rajabapaniah, Orchard Manager, A. R. S., Guntur,	L, a. p. for 30 days from 3—1—40.
„ S. Muthuswami, A. D., Madurantakam,	L. a. p. for 1 month and 2 days from 15—1—40.
„ K. M. Jacob, A. D. (on leave) Challisseri,	Extension of leave on half average pay on m. c. for 3 months.
„ C. S. Seshagiri Iyer A. D. (on leave)	L. a. p. for 4 months from 20—9—39.
„ P. Nagadhara Naidu, Asst. A. D., Madakasira.	L. a. p. for 1 month from 5—12—39.
„ K. Govindan Nair, Asst. in Chemistry, Coimbatore.	L. a. p. for 3 months from 3—1—40.
Janab A. Abdul Samad, Asst. in Oil Physics D. F. S., Hagari.	L. a. p. for 30 days from 3—1—40.
Sri. P. S. Venkuswami Ayyar, A. D, Chingleput.	L. a, p. for 3 months from 3—1—40.

,, R. Balasubramaniya Ayyar, Asst. in Cotton A. R. S. Guntur. L. a. p. for 29 days from 3—1—40.
,, L. Sankarakumara Pillai, A. D., Rasipuram. L. a. p for 2 months from 4—12—39.
,, V. Kuppuswami, F. M. A. R. S., Nandyal. L. a. p for 3½ months from 22—12—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the Quarter Ending 31st December 1939.

A. Books.

1. *Soil Science.* Isgur, B. (1938). 2. *Micropedology.* Kubiena, W. L. (1938). 3. *Handbook of Fertilisers.* Custafson, A. F. (1939). 4. *The Minor Elements & Their Relation to Plant and Animal Nutrition—Bibliography.* Wallis, L. G. (1939). 5. *The Crop Atlas of India.* Revised Edition (1939). 6. *Hesperides: A History of the Citrus Culture and use of Citrus Fruit.* Tolkowsky, S. (1939). 7. *The Vegetable Growing Business.* Watts, R. L. and Watts, G. S. (1939). 8. *Diseases of Vegetable Crops* (Revd. Edn.) Walker, J. C. (1939). 9. *Farming: How to begin.* Street, A. G. (1939). 10. *Standard Methods for the Examination of Dairy Products.* American Public Health Assn. Publication (1939) 11. *Price fixing by Government in the United States 1926—1939. A list (selected) of references.* Bercaw, L. C., Comp (1939) 12. *Advertising: Theory and Practice.* Sandage, C. H. (1939).

B. Annual Reports, Proceedings etc. of Agricultural Department.

1. Madras Electricity Dept., Annual Report for 1938-39. 2. Madras Chemical Examiners' Annual Report for 1938. 3. U. F. A. S. I. Tea Scientific Dept., Annual Report for 1938-39, 4. Bengal Agricultural Dept., Experimental Station Report for 1937-38. 5. Bombay Agricultural Dept., Annual Report for 1937-38. 6. India Meteorological Dept, Annual Report for 1938-39. 7. Imperial Dairy Expert (New Delhi) Annual Report for 1937-38. 8. Indore Institute of Plant Industry—Progress Report for 1938-39. 9. Indian Central Cotton Committee—Annual Report of the Director of the Technological Laboratory for 1938-39. 10. Central Provinces and Berar Agricultural Department—Annual Report of the Experimental Farms for 1937-38. 11. Punjab Irrigation Research Institute Annual Report for 1938. 12. United Provinces Agricultural Dept., Annual Report for 1937-38. 13. Burma Agricultural Dept., Agri. Stations Report for 1938-39. 14. Amani Agricultural Research Station Annual Report for 1938. 15. National Institute for Research in Dairying (Reading) Annual Report for 1938. 16. Fiji Agricultural Dept., Annual Report for 1938. 17 Louisiana, Crowley Rice Experiment Station—Biennial Report for 1937—1938. 18. Proceedings of the Association of Land—Grant College and Universities for 1938. 19. Wisconsin Agricultural Experimental Station—Annual Report for 1938.

C. English Translations of Scientific Articles published in other Languages.

1. The Origin and Selection of the Cotton Variety by Tangins. 2. The Soviet Breeding Methods by N. I. Vavilov. 3. Intravarietal Crossing by V. F. Khitrinskii.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVIII.] FEBRUARY 1940 [No. 2.

EDITORIAL

Indian Farming:— We welcome to the ranks of Agricultural journalism in India the new monthly magazine *Indian Farming* which replaces what is now familiar to our readers as *Agriculture and Live stock in India*. An all-India monthly magazine which can collect, collate and purvey various items of scientific information pertaining to the basic industry of the land in a form which is intelligible to the layman has been a long-felt need. We are glad to note that the journal aims at "transmitting the results of research from the laboratory and the experiment farm to the cultivators". Constituted on an all-India basis and with adequate financial backing, we cannot think of any organisation in the country which is more competent than the Imperial Council of Agricultural Research to undertake this onerous task. The first number of the magazine is a commendable effort in translating the aims of the journal into action and we hasten to congratulate the council on their venture which has materialised not a day too early. The number contains, besides several interesting articles, a plea by the Hon'ble Kunwar Sir Jagadish Prasad, Member for Education, Health and Lands with the Government of India, for paying special attention to the promotion of Agricultural Research during the period of war. The get up of the magazine is all that can be desired in an official publication and we commend the magazine to our readers and trust that they will extend to the new-comer the patronage it so richly deserves.

Dearer Railway freights:— The recent decision of the Government of India to increase the freights on goods by 12½% is disconcerting news to the agricultural and industrial interests in the country. In India where the cultivator's produce has to be hauled over long distances before reaching the ultimate markets, any action which deters the free movement of commodities is bound to react adversely on the population. It may be observed that owing to the exigencies of the war, the competition between the railways on the one hand and coastal shipping and road transport on the other is fast waning and the decision to raise rail freights at a time when the country is slowly yet steadily recovering from a long period of trade depression, is unfortunate. It is the primary producer of the soil who will eventually share the brunt of any set-back and for this reason we trust the Government of India will think over their decision before putting it into execution.

Fodder Crops in the Madras Presidency—A Review.

By RAO BAHADUR G. N. RANGASWAMI AYYANGAR, F. N. I., I. A. S.,

Millets Specialist and Geneticist,

and

T. R. NARAYANAN, B. A. (Cantab), B Sc., Ag.,

Assistant, Millets Breeding Station, Coimbatore.

(*Continued from the previous number*)

Lucerne (Medicago sativa.) Often termed the queen of forage crops, this is perhaps the most highly esteemed fodder in this province, as elsewhere in India. It has not, however, spread so well in Madras as in Western India ; here it is still confined to the Government Farms and their neighbourhood. Though originally a native of temperate Asia (it is mentioned in the Bible) it seems able to stand the hot Indian climate very well indeed, although of course, the cuttings are heavier during the cold months of November-January than those from May-July. The crop needs a deep, well drained loam rich in lime, with adequate manuring and irrigations. Sullage water also can often be used with advantage, but soil alkalinity is fatal to its success. Being a rich feed, one or two pounds per day per animal is ample, so that in most places it need only be grown in small plots adjacent to wells. Apart from its value as a forage crop, lucerne is also reported as useful in the control of malaria. It is of course well known that malarial mosquitoes live, not only on human blood, but often feed on plant saps also. When they take in the lucerne sap, the organisms causing malaria are destroyed, rendering the mosquitoes harmless. Thus Egypt is believed to be free from malaria chiefly because lucerne is grown so extensively there. In the Argentine also, a similar thing is noted, and is corroborated by Russian workers in the Caucasus region. In Madras, lucerne was first introduced in 1916 on the Central Farm, Coimbatore, where it has ever since been a prominent and regular crop on about 2 acres. The cost of cultivation was rather high in the beginning (149 lb. per rupee in 1917, or Rs. 122 per acre) but dropped down to about 800 lb. per rupee in 1930. The average annual yield works out to 36,000 lb. in about 10 to 12 cuttings, at a cost of 425 lb. per rupee. The sale of lucerne in small bundles is a recent feature of the Coimbatore fodder supply. Attempts to introduce this crop in the Circars have not, on the whole, been very successful. At Samalkota it was tried in 1931 on a small patch and gave a calculated outturn of 25,000 lb. but was not continued in subsequent years. At Guntur the yield was only about 650 lb. per acre, nor was it much better at Chintaladevi where the maximum itself was only 1,040 lb. At Hagari it was grown for two years (1918 and 1919) and then dropped, and resumed in 1922 from which period it has been a regular crop on about one acre. On the East Coast it has figured in a small patch of only 3 cents at Palur, but

has yielded 14,100 lb. at Tindivanam, and has been pronounced a success at Aduturai. At Hosur, lucerne was a prominent crop in the days of the Army Remount Depot for nearly fifty years, and was then popular among the ryots all round, but when this depot was closed down, lucerne cultivation in the neighbourhood also died out. It is strange how such an excellent crop could have failed to catch on with the local ryots, but probably its heavy water requirements and some difficulty in getting good seed might have contributed towards such a fade-out. On the Cattle Farm, its cultivation was naturally resumed from 1924, with an average annual acre yield of 30,220 lb. on about 4 acres each year. Attempts to introduce it on the West Coast were all failures; the heavy rainfall, coupled with the shallow lime-deficient laterite soils was probably not quite suited to this crop. It has however been a success at Koilpatti with 27,300 lb. in six cuttings for the year, and also on the Hills at Nanjanad, giving 27,400 lb. per acre per annum.

An allied crop berseem (*Trifolium alexandrinum*) was tried at the Central Farm in 1924 and at various other centres (viz., Hosur, 1928, Samalkota 1929, Anakapalle 1933, and Koilpatti 1935), but was found very much inferior in outturn, and was unable to withstand frequent cuttings like lucerne.

Pillipesara (Phaseolus trilobus). This is perhaps the most popular fodder and green manure legume on the deltaic tracts of Kistna and Godavari. It has also subsequently been tried and found good in other parts of the presidency as well. It is a wiry-stemmed, drought resistant plant of sprawling habit that could stand two or three cuttings and then give a fair outturn of seed as well. It is more adaptable to adverse conditions and less susceptible to insect pests than sunnhemp. At Samalkota it was tried in 1929 at different sowing periods, and sowing it in November in the standing paddy was found the best practice. The yields averaged about 15,600 lb. per acre. In the Maruteru tract, pillipesara was well known even before the advent of the Station, the ryots sowing it along with other legumes, from June onwards on field bunds kept specially wide for the purpose, and cutting it two months later. With monthly sowings on different bunds they secure a continuous supply of green forage up to the next February or March. For green manure it was more usual to sow it in November, as at Samalkota, in the standing crop of paddy, utilize the first growth for fodder upto March, and plough in the subsequent flush for the main paddy crop. It is common in this tract to top off overgrown paddy plants in September and utilize them as green fodder. Pillipesara is suggested as very suitable for mixing with these toppings and making silage. At Guntur where it was first introduced in 1927 it has given an average yield of 10,700 lb. as a punasa crop (sown in July and harvested in September), and 11,200 lb. per acre at Nandyal. A proportion of 3 parts of Jonna to 1 of pillipesara was found very suitable at Guntur and Coimbatore, for improving the feeding value of the mixed fodder without causing any appreciable

loss in either grain or fodder yield, but at Nandyal such mixtures were found to pull down the grain yields of jonna.

Curiously enough, pillipesara, although successful at Nandyal, did not fare so well at Hagari, the yields even under irrigation never exceeding 6,700 lb. per acre. On the Ongole tract in the Nellore district, it was a common dryland crop even before the Cattle Breeding Station was opened, and was of course, a regular crop on this station, giving an average outturn of 2,200 lb. green fodder from the drylands. On the East Coast, where it was introduced from the Circars in 1931, it has been reported as being quite a success. Thus, at Aduturai, it gave 16,000 lb. on the average, for the April-sown irrigated crop. Two cuttings are usually taken from this crop by November, and it is then left for seed, the pods being collected in January. The Maruteru practice of sowing in November in the standing paddy crop was tried with success here also; cholam is often mixed with pillipesara, and the first cutting utilized for fodder, the second flush being ploughed in later on for the subsequent crop of paddy. Another practice that was found successful was to grow a mixed crop of maize and pillipesara on the wet lands from June to September and utilize it both as green forage as well as a silage material. In the Mettur project area of Pattukottai, and also at Gudiyattam, pillipesara has been tried and found quite promising. It is one of the standard green manure crops on the Central Farm at Coimbatore, both in wetlands as well as garden lands. The wetland yields work out to an average of 11,000 lb. per acre at a cost of about Rs. 4. At Hosur it has figured regularly since 1929 on the drylands, with an average yield of 6,800 lb. On the West Coast and the Hills, pillipesara was found unsuitable. At Koilpatti it was first tried in 1931 and has proved a success both on the dryland black soils and the irrigated red soil area, with yields of 3,200 lb. and 18,500 lb. respectively.

Sunnhemp (Crotalaria juncea). This is one of the best dual-purpose legumes available in this province, coming in handy both as a fodder as well as green manure. It grows well on a wide variety of soils, but is rather badly susceptible to insect damage. In the Circars it is a common garden land green manure round about Anakapalle, often sown along with other pulses, in May and harvested by August or September. In the Ganjam district however, there is a curious prejudice, that its cultivation could be done only by certain castes, although attempts have been made at the Berhampur Rice Research Station to popularise it in the tract. In the deltaic regions, of Samalkota and Maruteru, it is usually sown in November in the standing paddy crop, along with other pulses like black gram and green gram. The pods from these are gathered in February and the sunnhemp is grazed down or cut for hay, or else sometimes ploughed in for the subsequent crop of sugarcane. It was found however, that this sowing in November did not always give a good crop, as the damage from caterpillars was often very much more severe than when grown in March under irrigation. The yields then were much heavier, averaging about 14,300 lb. per acre at Samalkota

and 15,700 lb. at Maruteru. Although sunnhemp is so popular, the seed supply has always been a problem in both these tracts. Usually the seed had to be obtained from the upland taluks, through middlemen, who often charged as much as Rs. 30 or sometimes even upto Rs. 50 per bag of 160 lb. Consequently attempts were made to produce the seed locally. It was found that by sowing sunnhemp in September on field bunds, and taking care to nip off the top shoots just before the floral buds appeared, buds were induced to form in greater profusion on the axils of leaves and a good seed crop was secured without difficulty. The cost in this case worked out only to about a rupee per 160 lb. of seed, as against Rs. 30 or Rs. 50 often charged by the middlemen. Sunnhemp has been a fair success at Guntur, yielding about 2,000 lb. of dry fodder as a rainfed crop sown in July or August. The optimum time for sowing was found by experiment to be the second week of August. It has not been so good at Hagari. There the average yield, for an irrigated crop sown in July and pitted for silage in October, has been only 6,000 lb green fodder per acre. On the drylands at Nandyal it was a failure, although a very good yield of 26,000 lb. has been recorded one year (1925) from the wetlands of the Station. On the Ongole Cattle Farm at Chintaladevi it was a regular crop each year on about 25—30 acres, both as a pure crop as well as mixed with other cereals like *jonna* and *sajja*, and legumes like *horsegram* and *pillipesara*. The earlier July sown crops were in general better than the September sown, yielding 1900 lb. of dry fodder while the yields from December sowings were even more uncertain than the September crops. At Palur, sunnhemp is a regular green manure crop sown in June, with an average outturn of 5,100 lb. The yields have been even better at Palakuppam with 3,400 lb. dry fodder per acre, while at Aduturai, where it was first introduced in 1931, the June sown crop has yielded 16,300 lb. at a cost of 10 annas per 1000 lb. If sown in December, after the harvest of paddy, the crop was usually ruined by caterpillars, and the outturn never exceeded 1,900 lb. per acre. On the Central Farm, sunnhemp has not been very prominent as a fodder crop, owing probably to the presence of a better feed in lucerne, although it has been one of the standard green manures both in the wetlands as well as the garden and dry lands of the Farm. At Hosur however, it has been a regular fodder for hay and silage on about 10 acres each year. The average yield has been 8,600 lb. per acre. On the West Coast, it could be grown only in September as a rainfed crop on *modan* lands (hilly dry-land areas). The yield in such cases has been about 4,700 lb. per acre. As an irrigated crop in March at Pattambi, an acre yield of 10,000 lb. was recorded in one year (1932), but on the whole, sunnhemp has not been quite suited to West Coast conditions. At Koilpatti it has been regularly grown since 1931 yielding 8,700 lb. on the average as an irrigated crop in the red soil area, and used for making silage.

Cowpea. *(Vigna unguiculata (L.) Walp).* Among all the fodder legumes, cowpea seems better suited to the humid West Coast than any-

where else. In the Circars, it was found at Samalkota, to do better when sown in November amidst the standing paddy, than as an irrigated crop in February. At Maruteru, it figures along with sunnhemp and pillipesara, as one of the bund-sown fodders in paddy lands. Though grown at Guntur from 1933 till 1936, it has been only as a green manure, and never as a fodder. At Hagari, it was a failure, even with irrigations. At Chintaladevi it was a regular fodder crop in the *punasa* season as long as the farm existed, but the yields were uniformly low, averaging only 1,500 lb. green fodder per acre. At Hosur the average was 6,600 lb. Cowpea may be said to have been a success at Palur and Aduturai, with a cut of 6,400 lb. and 10,700 lb. per acre respectively, but at both these stations it was grown more for green manure than for fodder. All the same, its success or otherwise, serves as an index to its fodder possibilities as well. On the Central Farm, cowpea has not, on the whole, been very prominent, either as a fodder or as green manure. On the West Coast, however, it has been the most successful among all the legumes tried, both for green manure and as a silage material. The optimum time of sowing was from the end of May till early in June; earlier sowings resulted in the crop getting caught up in heavy rains, just at the flowering stage. On the Southern tract, cowpea was a failure on the dryland black soils of Koilpatti although under irrigation it gave up to 14,500 lb. in the red soil area.

Horsegram (*Dolichos biflorus*). This is a hardy, quick-growing pulse, sown usually on the poorest soils. It is probably the best leguminous rain-fed fodder crop for light soils, especially on those inclined to be shallow and somewhat stony. Being itself intended as a restorative crop, it is seldom, if ever, manured at all, although as Benson reported from Saidapet in 1879, it is capable of yielding as much as 10 600 lb. within about 70 days, under even moderate applications of manure to the rainfed crop. It makes excellent hay, with a very pleasant smell, although losing about 75% of its green weight on drying. On the Northern Circars, horsegram is sown broadcast in the *Peddapanta* (August—September) season at Anakapalle, following cereal crops like Punasa (June—July) ragi or *Ganti* (Cumbu). In the deltaic regions however, as at Samalkota and Maruteru, it is one of the usual pulses sown in November just before the harvest of paddy. The pods are gathered in February and the *bhusa* (residue of vines and empty pods) used for cattle feed. On the uplands, i.e., the tract between these heavy soils of the deltas and the hilly regions of the interior, horsegram is one of the chief rain-fed crops on light loams, being sown broadcast in October, after an early crop of gingelly or a cereal. and harvested by February. In Guntur also, horsegram is an important recuperative crop following tobacco in October. On the heavy blacksoils of the Ceded districts, as at Hagari, it is not so popular, although it has been grown on the farm, off and on, with an average yield of 4,800 lb. green material per acre, from rainfed crops and 8,100 lb. under irrigation. At Chintaladevi, horsegram was one of the chief November sown crops, after cereals like jonna, and cumbu. It was

grown either pure or mixed with other cereals or pulses like sunnhemp or pillipesara. The yields, however, were low as a rule, averaging only 900 lb. per acre. On the East coast, horsegram has been tried only at Palakkuppam and that too as a green manure on about 50 cents in one year (1931). Sown after the harvest of cumbu in November, it yielded about 5,600 lb. green material. On the Central Farm at Coimbatore, it has been quite a handy crop on the red soil drylands from 1926 onwards, with an average yield of 3,900 lb green material per acre. In the Hosur tract, horsegram, lablab and gingelly are grown on a scale sufficient even for exporting to other districts. On the Cattle Farm, it has been a regular crop every year from the inception of the Station, with an average yield of 2,000 lb. of green fodder per acre. On the West Coast in the vicinity of Taliparamba, it is mainly a grain crop, sown on the drylands after harvesting *modan* paddy, often mixed with *samai (Panicum miliare)* gingelly or sweet potato. The *bhusa* that remains after the grain is threshed out, is an incidental cattle-feed. The yields of grain, however, have usually been very low, often interspersed with failures, both at Taliparamba as well as at the Coconut Stations. At Pattambi, horsegram was tried in 1933, as a green manure but gave only 3,050 lb per acre as against 10,700 lb. from cowpea under similiar conditions. In the southern tracts, as elsewhere, horsegram is a poor-soil crop of the dry lands, chiefly red-soil areas, where it is sown broadcast, either alone or mixed with samai. At Koilpatti it has yielded on the average, 450 lb. of grain per acre from the black soil area, while under irrigation, on the red soil area a phenomenal yield of 12,700 lb. green material per acre was recorded in 1936.

Other Pulses. (Black gram, Bengal gram, Green gram, Theegapesara, Lablab, Soy beans, Lentils and Lupins.)—The first four of the above eight are indigenous catch crops grown on all types of lands, just as it is convenient or necessary. Since these lands are usually poor, the yields too are poor. It is very seldom that any of them figure as a pure fodder crop—the grain is needed for human food and the *bhusa* is an incidental cattle-feed.

In the Northern Circars, green gram (Phaseolus mungo L.) is sown often mixed with other pulses as a second crop in November-December. Thus at Berhampur it has been grown along with kolinji and indigo on ploughed fields after paddy and harvested two months later, in February. At Anakapalle it usually follows ragi and precedes gingelly in the garden land rotation; at Samalkota, it is mixed with black gram, *theega-pesara* (creeping green gram) and sunnhemp and sown broadcast in the standing paddy in November. After the harvest of paddy, these pulses remain in the field till February, when the pods are gathered from the grams and the sunnhemp cut for hay or grazed down. On this Station, *theega-pesara* (Phaseolus mungo L.) has done very well as a green manure crop, the average yields from the March-sown irrigated crop being 14,500 lb. per acre. Black gram (Phaseolus mungo var. radiatus) green gram and

Bengal gram on the other hand, have been primarily grain crops, the fodder value being incidental. Soy bean (Glycine max. Merr.) trials were also conducted from 1932 onwards but here too, all the foreign American types failed, only two Burmese varieties Behrum and Pe Ngypi showing any signs of promise. In the Maruteru tract, black gram and horsegram are sown on dry lands in October, and harvested by February; in the wet lands, black-gram, cowpea, sunnhemp and pillipesara are sown, as described already, on field bunds from July onwards—for periodical cuttings of fodder.

In the Ceded districts, Bengal gram is the usual cold weather pulse crop. At Chintaladevi, almost all the legumes, Blackgram, Bengal gram, green gram, and lab lab were sown each year, chiefly as mixtures with *Pedda jonna* and *Pairu jonna* to improve the feeding value of the jonna hay and straw. On the East Coast, at Palur black gram and Bengal gram were tried in 1915, as a second crop after early cumbu, but were given up as not sufficiently promising. Soy beans have fared no better, both here and at Palakappam and Aduturai, only green gram being any good at this last place. On the Central Farm at Coimbatore, Bengal gram is the usual cold weather pulse on the black soils, after periamanjal cholam the previous year. The yields depend so much on the extent of dewy nights at the time of pod setting that they fluctuate very widely around a low average of 300 lb. per acre. Black gram too is similar. The *bhusa* from both is esteemed as a cattle-feed. At Hosur, there is no specific reference to these minor pulses. Soy beans have been reported, after a few years of unpromising trials, to have yielded 5,400 lb. green fodder per acre in 1936. This crop has been equally difficult to raise successfully on the West Coast also. and does not on the whole seem to have much scope in the Presidency, either for grain or as fodder.

In the southern tract, at Koilpatti, owing to the high average temperatures prevailing even in December—January, Bengal gram has never been a success. The other pulses too, have been equally poor on the black soils, the yields ranging around only 200—250 lb. per acre; in fact, as noted by H. C. Sampson as early as 1910, there is really no suitable pulse for the black soils of this tract. Under irrigation, however, in the red soil areas, black gram yielded in 1936 as much as 11,300 lb. fodder per acre, thus indicating the possibilities of these pulses under liberal treatment. On the hills, at Nanjanad, where only lupins come up well as a green manure, Bengal gram and soy beans also were tried in 1935, and found to be somewhat promising.

Miscellaneous Fodders. *Sunflower (Helianthus annuus).* This is a quick growing plant capable of heavy yields, but is not very much relished at first by cattle, so that it seems better suited for making silage than for feeding green. It was first tried at various centres in this Presidency in 1924 and was a success at Chintaladevi with an average yield of nearly 10,000 lb and at Hosur it has been a regular crop since 1924 on about 2—4 acres each year with an average of 31,700 lb. per acre. On the

Central Farm, however, it is not mentioned after its first trial in 1924, when it gave an outturn of 7,000 lb. per acre. On the West Coast the laterite soils are presumably too shallow for its success, as the yields were all along very poor. As a rainfed crop on the black soils, at Koilpatti, it was noted as promising in 1929, the only year it was tried there. Sunflower was a failure on the hills.

Sweet potato vines *(Ipomaea batatas)*. This bye-product of sweet potato cultivation is not only a palatable green feed but has also been noted to stimulate milk secretion. At Chintaladevi it figured from 1921 to 1924 with an average outturn of 8 000 lb. vines per acre, and at Hosur too, it has been a regular crop since 1932, with an average of 29,900 lb. vines and 6,409 lb. tubers, while on the Central Farm also, it is mentioned (in 1929, 1933, and 1936) as grown and fed to cattle.

Kollaganjeru (*Ipomaea hispida*). This hardy, drought-resistant, trailing plant was tried first at the Millets Breeding Station, Coimbatore, and was found to yield about 2,800 lb. of fodder, of a very high feeding value, being particularly rich in proteins, fats and potash. It has also been grown with success on the black soils of Guntur and Bellary and recognised as a stimulating feed for milch cows. At Pattambi it suffered somewhat from too much rain in the north-east monsoon, but gave, in spite of this, an acre yield of 7,960 lb. and proved an effective smother crop for weeds.

Summary and Conclusions.

It would be useful at this stage to sum up the general position of fodder crops in the Presidency. In the Vizagapatam district, apart from the straw from major food grains, paddy, cumbu and ragi, and to a lesser extent, the straw from cholam, korra and samai; that are utilized for cattle, fodder crops as such are not raised to any appreciable extent. The haulms and *bhusa* from pulse crops like black gram, green gram and horsegram, and groundnut also, are often utilized. Pillipesara is becoming popular in paddy lands both as a green manure as well as fodder. In the deltaic portions of Godavari, Krishna and Guntur also, pillipesara is a popular green fodder, while sunn-hemp is another common fodder crop, usually made into hay and stacked along with paddy straw. In the dry lands of these districts, however, since what little grazing was available once is all gone now, cholam either pure or mixed with pillipesara, is grown as a fodder crop in the early season and as a grain crop in the late season. In the Ceded districts, the area cropped per pair of cattle is so large that in normal years the ryot gets all the fodder he needs from the jonna straw on this area. He is, as a rule, fully aware of the fodder value of mixing legumes with his cereal straw, but, with the seasons so uncertain, he is unwilling to risk pulling down his jonna yields by sowing such mixtures. In the black soils of the south, in Madura, Ramnad and Tinnevelly, the ryot usually reserves a portion of land for growing rain-fed cholam as a pure fodder crop, using a very high seed rate to get the stalks thin and fine. On the red soils, however, cholam is a grain crop.

Here, it is often mixed with pulses if rainfed and grown pure only when raised under wells. The fodder supply may be said to be adequate in these districts, but the same cannot be said of Tanjore and parts of South Arcot where paddy straw is the mainstay for cattle. Pillipesara has been a success here, so that it is worth while to advocate growing it either pure or mixed with fodder cholam in paddy lands from January till June when there is no paddy crop. Guinea grass and Napier's fodder also can be planted along bunds and sides of water channels. In the garden land districts of Coimbatore, Salem and North Arcot, cholam both as a rainfed as well as an irrigated crop, is the mainstay for fodder. Pulse mixtures too are a common practice. The merits of lucerne are getting to be well known and recognised in Coimbatore. In the town itself, a regular agency has sprung up, supplying lucerne for milch cows and jutka horses. On the humid West Coast (Malabar and South Kanara) green grass is available from July to December, and although the cattle are usually half starved for the rest of the year, from January to June, the raising of fodder crop is hardly ever practised. There seems to be a good scope here, for a wider use of forage crops like green cumbu and cowpea, converting them into silage for use during the dry months from January to June. In the Nilgiris also, the need for raising fodder crops is not yet felt, although here too, suitable crops are avilable, such as samai, teosinte and lucerne.

As regards the future prospect, it is safe to assume that most of the fodder requirements of the Province would continue to be met from an extension of the area under the crops reviewed above, although of course, the possibility of new introductions is not excluded. The Agricultural Department has demonstrated the utility of fodder crops like cholam, maize, guinea grass, Napier's fodder, lucerne and pillipesara. Further lines of useful activity, apart from the continuance of advice regarding the most suitable fodder crops for different localities, under dry as well as irrigated conditions, would be in the evolution of more strains of fodder sorghum, each best suited to particular tracts, and the isolation of better yielding types of other fodder and pasture grasses. In what may be termed sub-urban farming areas, there is a good scope for an intensive commercial cultivation of fodder crops, such as maize and lucerne and supplying their fodder for the town milch stock. Under such intensive cultivation, the question of rotations assumes less importance than in truly rural areas where, with the extensive type of dry land farming, it is vital to conserve the fertility of the land by a judicious rotation of crops.

Grass Flora of North and South Arcot Districts with special reference to fodder grasses.

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The North and South Arcot Districts receive a total annual rainfall of about 30 inches. The heaviest rainfall period is during the north-east monsoon between September and November. During the year (1939) the north-east monsoon was late and only about two inches of rainfall were received towards the end of September. The regular monsoon, however, commenced from about the middle of October. The grass survey was made between the 6th and 23rd of October. The grasses had just started fresh growth and a few were in flower which enabled their identification.

The soils of these districts are generally sandy loam. A large area is under paddy especially in the South Arcot District. There is, therefore, the necessity to maintain a large number of work bullocks and buffaloes. The question of large scale production of good fodder, therefore, is of utmost importance to the ryot in these districts.

The well-known *Kolukkattai* grass (*Cenchrus ciliaris* Linn.) of Kangayam tract (Coimbatore District) is absent in these Districts. Attempts have been made in recent years to introduce this species in the panchayat forest near the Arkonam Railway Station but it has not established well. The *Chengali* (*Iseilema laxum* Hack) of Ongole tract (Guntur District) is also practically absent except for a few stray plants in one or two places. The hill grass *Nendra pul* (*Sehima nervosum* Stapf.) is the best grass of these districts but occurs only in forest regions. It is present abundantly in the plains, forests and completely absent in the open pasture areas. In the former area this species is found to thrive better under trees and shrubs as is seen in the Arkonam panchayat forest. These observations indicate that this grass needs partial shade and does not thrive in open areas. The grasses of these districts may be divided into three groups :— (1) Pasture grasses (2) Forest grasses and (3) Grass weeds in cultivated areas.

Pasture grasses. The most important pasture grass, *Arugam pul* (*Cynodon*) is represented by two species, *Cynodon Dactylon* Pers. and *C. Barberi* Rang and Tad. The former has underground stolons and occurs in moist and stiff soils while the latter spreads superficially and occurs in fairly dry and sandy loams. *Amphilophis pertusa* Stapf. is next in importance and makes a matted surface with its creeping and long red stems rooting at the nodes. *Digitaria longiflora* Pers. and *Manisuris Myurus* L. spread all round by their long creeping branches, the former rooting at all the nodes and the latter at the basal nodes. These cover large patches of sandy loams and promise to be very good sand binders in addition to being good pasture grasses. The grasses of the pastures arranged according to their

predominance are :—*Cynodon Dactylon* Pers., *Cynodon Barberi* Rang. and Tad., *Amphilophis pertusa* Stapf., *Urochloa reptans* Stapf., *Dactyloctenium aegyptium* Beauv., *Paspalidium flavidum* A. Camus., *Perotis indica* O. Ktz., *Tragus biflorus* Schult., *Chloris barbata* Sw., *Aristida depressa* Retz., *Panicum psilopodium* Trin., *Eragrostis plumosa* Link., *Digitaria longiflora* Pers., *Digitaria marginata* Link, var. *fimbriata* Stapf., *Alloteropsis cimicina* Stapf., *Echinochloa colona* Link., *Sporobolus tremulus* Kunth., *Aristida Hystrix* Linn., *Chrysopogon aciculatus* Trin., *Manisuris Myurus* Linn., *Oropetium Thomaeum* Trin., *Urochloa panicoides* Beauv., *Iseilema laxum* Hack, *Trachys muricata* Steud., *Brachiaria distachya* Stapf., *Eriochloa procera* C. E. Hubb., and *Eragrostis riparia* Nees.

Forest grasses. The most important forest grasses are *Nendra pul* (*Sehima nervosum* Stapf.) and *Manjam pul* (*Cymbopogon coloratus* Stapf.). The latter has to be cut and fed to cattle before flowering as cattle do not relish it after flowering on account of its strong odour. It is necessary, therefore, in any scheme of rotational grazing in such forest regions where this species predominates, provision should be made for issuing grazing permits in such periods as to enable the cattle to graze before the grasses come to flower. This system will have the additional advantage of providing rich nutritious grazing as it is a well known fact that grasses are very rich in proteins in young stages and become less and less nutritious as they flower and set seed.

The forest grasses arranged according to their occurrence. *Cymbopogon coloratus* Stapf., *Heteropogon contortus*, Beauv., *Sehima nervosum* Stapf., *Amphilophis pertusa* Stapf, *Eragrostis bifaria* Wt et Steud., *Eragrostis brachyphylla*, Stapf., *Aristida depressa* Retz, *Aristida setacea* Retz, *Digitaria marginata* Link., var. *fimbriata* Stapf., *Melanocenchris monoica* C. E. C. Fischer, *Perotis indica* O. Ktz., *Chrysopogon montanus* Trin., *Eremopogon foveolatus* Stapf. *Cymbopogon caesius* Stapf, and *Cymbopogon Martini* Wats.

Grass weeds in cultivated crops. Grasses form the major portion of weeds especially in rainfed crops. These are not systematically removed. When the grasses have grown well they are pulled out and sold as cattle feed. Most of them are annuals and the commonest species is *Maththanga pul* (*Dactyloctenium aegyptium* Beauv).

Grass weeds in cultivated fields arranged according to their occurrence. *Urochloa reptans* Stapf, *Dactyloctenium aegyptium* Beauv., *Cynodon Dactylon* Pers., *Chloris barbata* Sw., *Brachiaria ramosa* Stapf., *Eragrostis pilosa* Beauv, *Setaria pallidifusca* Stapf et Hubb, *Panicum psilopodium* Trin, *Dichanthium annulatum* Stapf, *Panicum repens* Linn., *Eragrostis ciliarensis* Link, (*Imperata cylindrica* Beauv., var. *Koenigii* Dur., *Saccharum spontaneum* Linn found generally on bunds in rice fields), (*Echinochloa stagnina* Beauv, *Echinochloa crus-galli* Beauv., *Eragrostis japonica* Trin., occur in rice fields along with paddy), *Leptochloa chinensis*

Nees., *Sporobolus Wallichii* Munro., *Sporobolus scabrifolius* Bhide., and *Rottboellia exaltata* Linn. f.

Weeds other than grasses. Even though the weeds are undesirables some of them are readily grazed by cattle when found in pastures or eaten by them when hand fed. *Gisekia pharnaceoides* Linn. (Tamil: *Manal Keerai*) is a very common weed especially in sandy loams. It is a prostrate herb with fleshy leaves covering large patches of ground. It is collected from standing crops and fed to cattle and is much relished by them.

The following weeds are readily eaten and relished by cattle:

1. *Cyperus rotundus* L. (Fam: Cyperaceae) Tam: *Korai.*
2. *Gisekia pharnaceoides* L. (Fam: Aizoaceae) Tam: *Manal-keerai.*
3. *Commelina benghalensis* L. (Fam: Commelinaceae) Tam: Kaana.
4. *Digera arvensis* Forsk. (Fam: Amarantaceae) Tel: *Senchalaakku.*
5. *Borreria hispida* K. Sch. (Fam: Rubiaceae) Tel: *Mathana Akku.*
6. *Physalis minima* L (Fam: Solanaceae) Tel: *Budama Akku.*

The leaves of the forest tree *Turinje* (*Albizzia amara* Beauv.) and *Agathi* (*Sesbania grandiflora* Pers). which is grown in banana and betel vine gardens afford supplementary forage for cattle.

A list of the grasses of the North and South Arcot districts with short notes and local names for those not mentioned in the Grass Flora of Chittoor District (*Madras Agricultural Journal*, Vol. XXVII, January 1939,) is given.

1. *Imperata cylindrica* Beauv., var. *Koenigii* Dur. & Sch. (*Imperata arundinacea* Cyril.) Eng: Cotton grass Tam: *Tharpai pullu.* Tel. *Dharbha, Modewa gaddi.* *Kan: Sanna Dabbai Hullu* It is a perennial grass 1′—4′ in height. It thrives in moist situations. It spreads by the underground stems which are often very long. It is a pernicious weed in garden lands. It is a good sand binder. Grazed by cattle only when young and tender.

2. *Saccharum spontaneum* L Tam: *Viswamitra Darbhai,* Tel: *Rellu gaddi.* A perennial grass thriving in moist situations. It grows from 3′ to 6′ in height. It is a good sand binder often planted along water courses to prevent soil erosion. It is a good fodder for buffaloes.

3. *Sehima nervosum* Stapf. Tam: *Nendra pul.*

4. *Amphilophis pertusa* Stapf. Tam: *Chengaru pul*; *Kodi savaran pul.*

5. *Vetiveria zizanioides* Nash, (*Andropogon squarrosus* Hack.) Eng: The Khus-khus or Cus-cus grass. Tam: *Vilamicham pul,* Mal: *Ramachcham.* It is a coarse perennial grass with stout rhizomes. It grows from 3' to 4' in height. The aromatic roots are used for making screen mats (*thatties*) and fans. An aromatic and medicinal oil is extracted from the roots. It is grazed by cattle when young.

6. *Chrysopogon aciculatus* Trin. (*Andropogon aciculatus* Retz.). Eng: The Love-grass. Tel: *Puthi gaddi.* A perennial grass having creeping root stock. Stems erect, 1′ – 2′ in height, slender and leafy chiefly at the base. Grazed by cattle before flowering.

7. *Chrysopogon montanus* Trin. Tam: *Moonjan pul.*

8. *Dichanthium annulatum* Stapf. (*Andropogon annulatus* Forsk) Tel: *Molava gaddi.* It is a perennial densely tufted grass; stems erect or ascending, 1′ – 2½′ in height. It thrives in moist situations. It is one of the best fodder grasses and is supposed to increase the milk yield in cattle.

9. *Heteropogon contortus* Beauv. Tam: *Panni pul.*

10. *Iseilema prostratum* Anderss.

11. *Iseilema laxum* Hack. Tam: *Thenga Nari pullu.* Tel: *Erra Chengali gaddi.* A perennial grass growing from 1′ to 2′ in height ascending from a shortly creeping root stock. Stems, slender, simple or sparingly branched. It stands cutting well. It is considered one of the best fodder grasses and is the mainstay of the famous Ongole Breed of cattle.

12. *Eremopogon foveolatus* Stapf.

13. *Cymbopogon coloratus Stapf.* Tam: *Manjam pul.* It is the commonest grass in all the hilly tracts of these Districts.

14. *Cymbopogon Martini* Wats. Tam: *Kaavaadu pul.*

15. *Cymbopogon caesius* Stapf. (*Andropogon Schoenanthus* L., var. *caesius* Hack.). Tam: *Vella Munjan pul, Komatchi pul*; Tel: *Kasi gaddi*; Kan: *Kasi hullu.* A perennial erect grass growing from 2′ to 3′ in height. It has a strong odour due to the presence of an essential oil. It is used generally for thatching. It is nibbled by cattle when young.

16. *Rottboellia exaltata* L. Tam: *Shona pul*; Tel: *Konda panuku.* It is an annual, sometimes perennial, growing from 2′ to 10′ in height. Stem tall, erect, branched above, and often with tilt-roots from the lowest nodes. The plant is beset with rough hairs. It is not eaten by cattle but if grazed accidentally the animal suffers by excreting blood.

17. *Manisuris Myurus* L. (*Rottboellia Myurus* Benth.) Tam: *Waritsira pul*; Tel: *Nalla panuku.* It is a spreading grass rooting at the basal nodes of the branches. It is a good fodder grass.

18. *Digitaria marginata* Link., var. *fimbriata* Stapf. Tam: *Kakkai Kal pul.*

19. *Digitaria longiflora* Pers. It is a spreading grass rooting at all the nodes. It thrives in sandy loams. It is a good sand binder. It is grazed readily by cattle.

20. *Alloteropsis cimicina* Stapf. Tam: *Chena pul.*

21. *Eriochloa procera* C. E. Hubb. (*Eriochloa polystachya* H B. & K.). Tam: *Tandambaran pul, Karungani pul.* It is a perennial grass growing

from 2′ to 5′ in height. It thrives in moist situations often seen on the bunds of rice fields. It is a good fodder grass.

22. *Brachiaria distachya* Stapf.

23. *Brachiaria ramosa* Stapf. Tam : *Pala pul, Kamban pul.*

24. *Paspalidium flavidum* A. Camus. Tam : *Arisi pul.*

25. *Urochloa panicoides* Beauv.

26. *Urochloa reptans* Stapf. Tam : *Gunugu pul, Seela pul.*

27. *Echinochloa colona* Link. Tam : *Saani pul*; Tel : *Oodara Kasuvu.*

28. *Echinochloa crus-galli* Beauv. (*Panicum Crus-galli* L.) Tam : *Oothu pul*; Tel : *Pedda-wundu*; Kan : *Kadu dabhai hullu.* It is a tall grass growing from 3′ to 4′ in height. It thrives in moist places. It is a common weed in rice fields. The grain is eaten by the poor. It is a good fodder.

29. *Echinochloa stagnina* Beauv. Tel : *Bontha Oodu*; Kan : *Kadu dabhai hullu.* The habit and the uses are similar to *Echinochloa crus-galli* Beauv.

30. *Panicum psilopodium* Trin. Tam : Chinna samai pul ; Kadai Kanai, Kalam pul. It is an annual growing from 1′ to 2′ in height. This is the wild form of the cultivated Samai, the little millet (*Panicum miliare* Lamk). It is readily eaten by cattle.

31. *Panicum repens* L. Tam : Tandangattai pul.

32. *Setaria pallidifusca* Stapf. et Hubb. Tam : Kulla nari pul.

33. *Cenchrus ciliaris* L (*Pennisetum cenchroides* Rich.) Tam: *Koluk-kattai pul.* It is a perennial grass growing from 1′ to $2\frac{1}{2}'$ in height. It is decumbent and much branched from the base. It thrives in dry localities. It stands cutting well. It is the mainstay of the Kangayam (Coimbatore District) breed of cattle. It has been introduced in one or two places in this district but is not thriving well.

34. *Aristida depressa* Retz. Tam : *Thodappan pul.*

35. *Aristida setacea* Retz. Tam : *Thodappa kuchchi.*

36. *Aristida Hystrix* L. Kan : *Bili, Vunugada hullu.*

It is a perennial grass growing from $\frac{1}{2}'$ to 2′ in height, from a creeping root stock. Stem diffuse and ascending. It is not eaten by cattle because of the very long awns.

37. *Trachys muricata* Steud.

38. *Tragus biflorus* Schult. Tam : *Ottum Kai pul.*

39. *Perotis indica* O. Ktz.

40. *Sporobolus Wallichii* Munro ex Hook. f.

41. *Sporobolus tremulus* Kunth. Tam : *Upparugu, Uppurutnam pullu.* It is a stoloniferous perennial pasture grass. Stems slender growing from 4″ to 9″ in height. It thrives in alkaline soils and makes excellent lawns. It is grazed readily by cattle.

42. *Sporobolus scabrifolius* Bhide Tam : *Kosu pul.* It is an annual, growing from 1′ to 2′ in height. It thrives in black cotton soils. It is grazed by cattle.

43. *Leptochloa chinensis* Nees. Tam: *Aeri pul;* Kan: *Kadu sanna kari sajjai hullu.* It is an annual, growing in moist situations. Stem erect or geniculately ascending, 2′ – 4′ in height. It is a good fodder for cattle.

44. *Eragrostis riparia* Nees.

45. *Eragrostis plumosa* Link. Tam: Poo pul.

46. *Eragrostis japonica* Trin. (*Eragrostis interrupta* Beauv. var. *tenuissima* Stapf.). It is an annual thriving in wet places. Stems erect or ascending growing from $1\frac{1}{2}'$ to 3′ in height. It is a weed in rice fields. It is grazed by cattle.

47. *Eragrostis cilianensis Link.* Tel: *Boosi Kasuvu.*

48. *Eragrostis pilosa* Beauv. Tam: *Kuthira val pul.*

49. *Eragrostis bifaria* Wt. et Steudl. Tam: *Ooththu pul.*

50. *Eragrostis brachyphylla* Stapf.

51. *Oropetium Thomaeum* Trin.

52. *Melanocenchris monoica* C. E. C. Fischer. (*Gracilea nutans* Koen.) It is a perennial grass growing from $\frac{1}{2}'$ to $1\frac{1}{4}'$ in height. Leaves mostly aggregated towards the base. It thrives in dry localities. It is grazed by cattle.

53. *Cynodon Dactylon* Pers.

54. *Cynodon Barberi* Rang. & Tad. Tam: *Jellada pul.*

55. *Chloris barbata* Sw. Tam: *Kodai pul,*

56. *Dactyloctenium aegyptium* Beauv. Tam: *Maththangai pul.*

Short notes and local names wherever available of the weeds other than grasses which are grazed by cattle are given below:—

1. *Cyperus rotundus* L. Tam: *Korai;* Kan: *Bhadra Hullu.*

It is a perennial sedge rapidly spreading by its underground stolons. It grows from $\frac{3}{4}'$ to $1\frac{1}{2}'$ in height. It is a pernicious weed of cultivated fields.

2. *Gisekia pharnaceoides* L. Tam: *Manal Keerai:* Tel: *Isika duntikoora.* A diffuse prostrate herb with fleshy glaucous leaves thriving in sandy soils. It is a medicinal plant and also employed as pot-herb in time of famine. It is much relished by cattle.

3. *Commelina benghalensis* L. Tam: *Kaana.* Stem 2′—3′ long, dichotomously branching from the base upwards From the lower nodes leafless underground branches proceed bearing white flowers which produce perfect seeds.

4. *Digera arvensis* Forsk. Tel: *Senchalaakku.*

An annual herb 1′—2′ in height having spreading branches.

5. *Borreria hispida* K. Sch. Tam: *Naththa Choori;* Tel: *Mathana Aakku.* A procumbent herb having quandrangular stems. It is common on the coast sands.

6. *Physalis minima* L. Tel: *Budama Aakku.* It is a herbaceous annual. Stem erect $\frac{1}{2}'$ – 1′ in height.

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Some Ploughing Experiments

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Every text book on agriculture emphasises the importance of preparatory cultivation for the raising of crops and every farmer will testify to the efficacy of the precultivation methods. In fact, the practice has become so time-worn and well established that any demand for proofs will be deemed as an outrage on truth. Yet it is true that an agronomist wishing to build up the science of cultivation will find little data to help him on while planning improvements. For example, the black soil farmer in the Bellary district uses a grubber for the preparatory cultivation, while his neighbour in the Nandyal valley prefers to plough his fields every year with inversion ploughs. On the other hand, the ryot in Tinnevelly district cultivates his land, only with a country plough. Again, there are variations in the time of doing these operations. In the Ceded districts, all precultivations are mostly done soon after the harvesting of the crop in contrast to the practice in the Southern districts, of waiting for a soaking rain to start ploughing. There are no evidences to indicate whether these methods are followed because of the fact that the fore-fathers were in the habit of doing these and the sons should adopt them as a matter of tradition. Further it is not clearly known which operations are essential for crop production and what frequency in each will prove most remunerative. The lack of knowledge on many of the fundamental points precludes one from getting the maximum benefit from each cultivation operation, from substituting the non-paying one by a better method, and from omitting altogether the superfluities. It can be said that the existence of such lacunae stands in the way of the rapid spread of improvements of cultivation in India.

Recently some of the accepted practices were tested on the black soils of the Agricultural Research Station, Koilpatti in Tinnevelli district in connection with the experiments conducted in the Madras fodder cholam* scheme financed by the Indian Central Cotton Committee. It is proposed to present here some of the results obtained therein, with the object of stimulating other workers to study these aspects in their tracts.

In one group of experiments, the effects of changes in the depth and in the time of ploughing on the yields of succeeding cotton were compared. In the case of studies in depth, one set of plots was ploughed with a monsoon plough to a depth of 4″ – 5″ and another worked with a turn-wrest plough to a depth of 8″ – 9″. In the two seasons of trial, the differences between the two variants were (*vide* table I) within the limits of random error

* Andropogon sorghums.

signifying that the changes in the depth of cultivation did not engender any marked effect on cotton yields under the conditions obtaining at Koilpatti.

TABLE I. Depth of ploughing.

Crop. Rain-grown *karunganni* cotton (G. arboreum).

No.	Nature of treatment	Yield of kapas in lb. per acre. 1933—34 I	1933—34 II	1934—35.
I	Deep ploughing (8 - 9″)	308	304	508
II	Shallow ploughing (4 - 5″)	340	293	448
	Critical difference.	60	55	77
	Conclusion.	Treatments are not significant.		
	Number of replications.	6	6	8

This conclusion is in agreement with those arrived at by many workers. Allan (1) after reviewing all the results of cultivation experiments conducted in Madras, Bombay and Central Provinces has stated that there is no real evidence to support the belief that deeper cultivation is essential to secure the best economic returns from crops raised on heavy soils during the monsoon, and that it will be sufficient if these soils are periodically ploughed deep. Russell and Keen (11) working at Rothamsted state that there is no virtue in ploughing to a depth of more than 4 inches.

In the experiments relating to the time of ploughing. the effect of ploughing in the stubbles with a monsoon plough soon after the harvest of the crop in February-March was compared during five seasons with that done in May-June soon after the receipt of the rains and also with ploughing late in August—September. The results are set forth in Table II.

TABLE II. Time of ploughing. (Yield in lb. per acre).

No.	Nature of treatments	Years 1933-34 I	1933-34 II	1934-35	1935-36	1936-37	1937-38
1.	Ploughing early (soon after the harvest of the crop)	304	296	479	...	...	...
2.	Ploughing season (soon after receipt of the first rains)	331	305	477	217	381	528
3.	Ploughing late (just before the sowing of the next crop)	338	295	...	226	406	516
	Critical difference	74	68	77	38	27	65
	Conclusions	3,2,1	2,1.3	1,2	3,2	3,2	2,3
	No. of replications	4	4	8	6	12	8

Once again the differences between the treatments were not significant. Such a finding is puzzling in view of the statements made by Russell (9) on the formation of soil crumbs. It is said that if ploughing is done at a critical period necessary for the maintenance of a proper regime for water

and air movements, a larger proportion of water resistant conglomerates is formed. Based on this, one will expect that the treatment—ploughing after the receipt of summer rains—would prove more effective. The data in the present experiments do not, however, support reasonable anticipations. The above results are also nct in harmony with there commendations made by Allan (1). He has suggested that ploughing the land soon after the harvest of the crop will be more advantageous than preparing the seed bed late in the season. In the present experiments, variations in the time of ploughing have not caused any differential effects. Possibly his recommendations may hold good in cases of deep ploughing where more time is needed for the weathering of the clods.

In a third set of experiments, the plots prepared with the monsoon plough were compared with those worked with *guntaka* (blade harrow). It is needless to say that in the former, there will be soil inversion, (though only to a small extent), and greater penetration of the implement. It will be evident from the data in table III (a) that very little difference in yield exists between the two methods of preparing the land. The above conclusion is further corroborated by the data secured in another series of experiments, where the same set of plots were precultivated in the same fashion year after year for four consecutive seasons so that the cumulative effects of the treatments were left in them. It will be seen from their data (table III-b) that except in the year when sorghum was grown on the plots, no distinct differences were noticed between the yields of plots prepared either with *guntaka* or with the plough. This is in agreement with the observations made in parts of Bombay presidency (5), but is at variance with those reported in the Central Provinces (2) and at Nandyal Agricultural Research Station in Madras (4) where increased yields are recorded by the use of implements causing soil inversion. Russel (10) however, remarks that no difference will result between ploughing and grubbing, provided that these operations are done at the critical period.

TABLE III-(a). Comparison of ploughing and guntaka working.

(Yield in lb. per acre).

No.	Nature of treatment	1928–29 Cumbu	1928–29 Cotton	1929–30 Fodder cholam	1932–33 Cotton	1933–34 Fodder cholam	1934–35 Cotton
1	Ploughing	473	352	1891	595	5049	450
2	Working with guntaka	475	354	2151	608	5568	493
Critical difference		46	36	Not possible to work.	48	Not possible to work.	81
Conclusions		1=2	1=2		1=2		1=2
No. of replications		6	6	2	8	2	4

TABLE III-(b).

No.	Nature of treatment.	Permanent cultural experiments. 1935–36 Cumbu*	1936–37 Cotton	1937–38 Fodder cholam	1938–39 Cottom
1	Ploughing every year	274	231	2178	328
2	Working with guntaka every year	307	240	1950	351
	Critical difference	30	18	124	44
	Conclusions	2>1	1=2	1>2	1=2
	No. of replications	6	6	6	6

* Pennisetum typhoideum.

In a still another series of experiments ploughing was compared with no ploughing for four seasons (table IV). Much to our surprise, ploughing did not produce any increase in yield in any of these years. On the other hand, the treatment 'no ploughing' gave a significantly higher yield in one year (1935—36).

TABLE IV. **Ploughing versus no ploughing. (Yield in lb. per acre).**

(a) (b)

No.	Nature of treatment.	Koilpatti Agricultural Research Station. Cotton 34-35	35-36	36-37	37-38	Koilpatti Agrl. Res. Stn. Permanent cultural Fxpts. Cumbu 35-36	Cotton 36-37	Irungu Fodder 37-38	Cotton 38-39
1.	Ploughing	450	261	396	528	274	231	2178	328
2.	No ploughing	433	302	380	505	275	243	1917	347
3.	Working with Guntaka					307	240	1950	351
	Critical difference	81	38	19	65	30	18	124	44
	Conclusions	1=2	2>1	1=2	1=2	1=2 3>2 3>1	1=2 =3	1>2 1>3 2=3	1=2=3
	No. of replications	4	6	24	8	6	6	6	6

(c)

No.	Nature of treatment	District trials: Kalukachalapuram Cotton 38—39	Kallupatti Cotton 1938—39
1.	Ploughing	280	512
2.	No ploughing	246	459
	Critical difference	39	37
	Conclusions	1=2	1>2
	No. of replications	8	6

A somewhat similar behaviour was noticed in the permanent cultivation experiments mentioned in the previous paragraph. They contained three treatments, viz., one ploughed every year with monsoon plough, the second not ploughed at all and the third worked with *guntaka* every year. In the 'not ploughed' plots, stubbles and weeds, if any, were handpicked and the

seeds were drilled and covered by *guntaka*, as in the other two treatments. When the data of the 'ploughed' were compared with those of the 'not ploughed' it is seen (table IV-b) that the yield levels of two treatments were similar except in one year when ploughing proved beneficial to the fodder cholam that was raised on them. No difference is also observed except in 1935—36, when the 'guntaka worked' and 'not ploughed' series were compared. It is plain from these that preparing the land either with *guntaka* or with monsoon plough is not an improvement over an undisturbed fallow. It may be stated here that these operations were performed at the normal time by experienced labourers who were actually farming their own lands before they were entertained on the agricultural station and as such the lack of difference could not be ascribed to any ignorance on their part in the art of ploughing.

Apart from these, two other experiments were carried out on farmers' lands in the nieghbouring villages on the advice of the agricultural demonstrators. Their data are set out in table IV-C. It will be seen there that in both cases, ploughed plots gave better results than not ploughed, but when analysed statistically one of them alone proved really more productive.

Now, these data relate to a number of crops for a number of seasons and point out definitely that preparatory cultivation practised on the black soils of Koilpatti farm needs reconsideration with regard to the desirability of discontinuing the superfluous operations with the ultimate aim of cutting down the cost of cultivation. Such a step will run counter to the age-long experience gathered on the effects of ploughing and will make all the farmers proclaim with one voice that there should be something wrong somewhere to get these unbelievable results. It can only be said that all precautions and care were taken in the layout and the conduct of the experiments and the agricultural operations were all done as stated previously by experienced men and at the normal time. It may also be pointed out that similar conclusions were arrived at by other workers. Ducker (6) cited an instance in the third conference of cotton workers held in London last September. He said that in Nyasaland, fields left without any cultivation till the planting time yielded as much as those receiving normal cultivation. Bradfield (3) remarked that we should look upon tillage operations, as we do a surgical operation, indispensable at times, but to be avoided whenever possible. Parbury (8) declared that annual cultivation is not good. Garner (7) stated that in Cambridge the effect of cultivation on yield was interesting since the same result was not obtained in two consecutive years and it would be better to plough in one year and to cultivate in another year. Workers at Rothamsted (11) concluded that cultivations in excess of those needed to produce a seed bed and to keep down the worst of weeds did not confer any further benefit and might even produce a reduction in yield, and that it was only where the soil conditions were very poor, it would be possible to produce a positive effect by cultivations.

An explanation for the strange results may perhaps be found if the purposes served by cultivation are examined. Every student of agriculture knows that preparatory cultivation is done in the tropics with a view to get a good seed bed, to facilitate easy penetration of rainwater and to produce tilth such that optimum conditions for plant growth prevail. Russell and Keen (11) state that according to Von Nitsch the fundamental usefulness of cultivation operation can be measured by the increase in the pore-space brought about during the growing season and that for every increase of one percent in the pore-space in the growing season, an increase of 2·5 to 3 percent in yield would result. One would infer from the negative results obtained at Koilpatti that the necessary requirements for a good seed bed and easy absorption of rain water exist in the heavy black soils and that the good tilth which is expected out of ploughing is not present there.

Now according to the recent findings obtained chiefly in U. S. S. R, a soil will maintain its tilth in good condition as long as soil aggregates remain without crumbling. The agents that destory the aggregates are cultivation, alternate wetting and drying, presence of injurious salts and also certain cropping systems. But it must be mentioned at the same time that when the land is ploughed at a critical period of moisture content (i. e. at what is called the sticky point), soil crumbs resistant to the action of water and implements are formed to the maximum extent and tilth is built up. It is only ploughing under dry conditions that shatter the aggregates to fine particles which block up the pores. On this basis it looks that ploughing the stubbles soon after harvest of the crop will be prejudicial to the formation of water resistant soil crumbs and that the practice of the farmer of the southern districts of Madras to wait for the rains to start ploughing seems to be sound in principle.

The failure of ploughing and grubbing to produce increased yields has, according to above statements, to be attributed either to the absence of any addition to the existing proportion of water-stable aggregates or to the non-stability of the particles that are actually produced during the process of cultivation. It is not known clearly which of the facts are really operative in the soils at Koilpatti. If it is the former, it will mean that the implements used are not performing the functions expected of them, and the cost of cultivation is being increased without any compensatory improvement in the soil. It may be perhaps worthwhile to test other implements with a view to select those that will lead to an increase of crop yields. If on the other hand the conglomerates formed by these implements are of such a transcient nature as to be easily destroyed by rains or by the sowing operations, it may connote that a state of equilibrium between the agencies in the soil favourable for the production of stable crumbs and the capacity of the implements has been reached possibly by the cumulative effects of the use of mould board ploughs for the past 25 years and that the addition of ameliorants like humus, lime or gypsum alone will bring about further improvement in soil structure. Or it may also mean that the soil condition

chosen at present for the working of the implements does not lie near the critical point, however much the labourers may be experienced in the choice of optimum periods for starting preparatory cultivation. At any rate, one point becomes evident from whatever angle the problem is looked at. That is the fact that we are not in possession of exact knowledge of the cardinal points of tillage, viz., the relationship between soil tilth and crop yield, and the type of implement that will bring about that relationship to the maximum level. If we are to make headway in the improvement of cultural methods accumulation of sufficient data on each aspect of pre-cultivation is a necessary pre-requisite. It is therefore incumbent on the part of all officers in charge of agricultural stations to examine how far the methods of preculti-vation prevalent in each tract are justifiable and remunerative and which operation can be safely omitted with no loss in yield and with an eye to reduce the cost of crop production. In addition, experiments are to be initiated with the object of determining the implements that can perform them in a shorter time with no fall in efficiency.

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SEA WATER FOR IRRIGATION

Sea water is made suitable for irrigation by replacing the cations and (or) anions it contains for cations and (or) anions having a fertilizing action by passing through a suitable ion exchange. A part of the salt may first be removed by other means. The exchange is treated with a mixture of NH_3 and KOH to regenerate the anions and with a mixture of H_3PO_4 and HNO_3 to regenerate the cations :— The *Punjab Agricultural College Magazine* Vol. 7. (January 1940).

SELECTED ARTICLE

Cold Storage and Transport of Tropical Fruits.

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Introduction. Steady and continued success in the important work of transporting tropical fruits to overseas markets calls for information on very diverse subjects, beginning with biological aspects in the plantation and not ceasing until the exotic commodity is finally gratifying the palate of the consumer. I shall indicate those aspects of the problem which appear to be of greatest importance to the worker at the tropical end of, what is, in fact, a very considerable chain of operations.

Of the large number of attractive fruits native to tropical and sub-tropical regions, only a few have yet attained to commercial importance as export crops. Relative to citrus and bananas, all other tropical fruits though their production could be greatly extended, occupy a very minor place on temperate markets and for the most part are only retailed in small quantities and at high prices for the delectation of connoisseurs.

In addition to the tropical fruits occasionally offered on temperate markets there still remains a very considerable number of exotic fruits whose overseas transport has not yet been attempted, or been taken beyond the preliminary experimental stages. For this seeming neglect many reasons can be advanced, including demand (which must first be created by an extensive advertising campaign), competition with other fruits, chiefly temperate, difficulties of consistent production shipping and cold storage facilities and the need for special picking, the high degree of wastage at present inseparable from the handling of these delicate commodities. With a few notable exceptions, in fact, the transport of tropical fruits is still in its infancy. With the improvement of transport facilities it may be anticipated that this situation will to some extent be modified and that an increased variety of properly ripened exotic fruits will regularly be offered on temperate markets. Accordingly, a wide and interesting field of scientific inquiry still awaits appropriate investigation.

It will be evident that by far the greater amount of information at our disposal is based on those fruits such as grape fruit, oranges, and bananas which might now be described as "standard" commodities. Pineapples, limes, mangoes and avocados also find their way to temperate markets, but in comparatively small quantities, leaving a host of others which are seldom or never exported.

Importance of Research on pre-storage aspects. It not infrequently happens that those who are responsible for the inspection of imported tropical plant produce find themselves faced with fruits exhibiting various pathological symptoms of the type described as "physiological" or functional diseases. In the absence of information from the tropical, i. e. producing, end, the correct diagnosis of such diseases may well prove a matter of considerable difficulty. Moreover, as it has been established that certain types of functional disease are a direct result of cold storage, or of improperly regulated conditions in the refrigerated holds, the inspector of imported produce may easily be led off on a false trail, to find in the end that a correct solution is not possible on the information at his disposal, having meanwhile incidentally incurred the enduring enmity of the ship's refrigerating engineer, the accuracy of whose records and depositions he may have had occasion to doubt. Such difficulties can be avoided but only if the effects of

all the pre-storage treatments to which the fruit has been subjected are known and understood. In illustration of this aspect, two instances may be cited. If Trinidad citrus fruits (grape fruit, oranges and limes) are picked while still covered with dew or after rain. the fruits are so turgid that the smallest amount of handling causes mechanical injuries and liberation of oil, which in turn gives rise to the type of superficial blemishing described as "oleocellosis". Again, in Trinidad grape fruit treated with borax solution before crating as a means of controlling blue and green moulds, the effect of the fungicide is to promote the activities of the fungus *Colletotrichum gloeosporioides* which is already present within the tissues as a latent infection. In its earlier stages the combination of borax injury and fungal activity yields blemishes whose appearance is suggestive of physiological injury. In both instances, the damage, which might easily be attributed to cold conditions during transport, are in no way caused by refrigeration. Bananas which have been cut too soon and held too long at tropical temperatures may become "stale" and tend to ripen during the overseas voyage. Here again a pre-storage and not a refrigeration factor is involved. Again, banana bunches which have hung too long on the tree because of poor growth conditions may appear suitable for harvesting, but may in fact have reached a maturity considerably beyond that which is desirable in fruit intended for overseas transport.

In general, pre-storage factors, environment, seasonal conditions, and plantation sanitation are important in determining intrinsic quality, keeping quality in storage, and wastage and must be given the same careful attention as those aspects which pertain directly to the subsequent refrigerated storage.

Harvesting Maturity. The question of harvesting maturity is specific to each kind of fruit, and criteria not infrequently of an arbitrary nature, have to be employed. To allow for the progress of ripening during transport and distribution. tropical fruits, as a rule, are picked somewhat immature. Thus the banana is reaped when it is still quite immature and green at stages described as three-quarters full', 'heavy three-quarters full' or 'full' according to the distance of the market for which it is intended. The necessity for harvesting fruits somewhat immature adds to the problems of the physiölgist, for whereas in some fruits the onset of ripening is indicated by well marked colour changes, in many others no colour change is apparent. and other means have to be devised in order that fruit shall be harvested at a constant maturity. With grapefruit and oranges, biochemical tests based on the percentage of total solids, and on the ratio of sugar to acid, have of necessity been adopted, particularly where early season fruit is being handled. The standards which have been found suitable in some countries, however, have not always proved rational or acceptable in others, and different local criteria have had to be devised. In different varieties of mango, it has been found convenient to use a morphological criterion of maturity. the relationship between the stem insertion and the degree of development of the 'shoulders' of the fruit (where growth is localized) being used for this purpose: otherwise in many of the best commercial varieties colour changes associated with ripening afford very little assistance indeed. Again, in green varieties of avocado, no good criterion of commercial harvesting maturity, other than a tentative ratio of fat content to the fresh weight. has so far been ascertained. In fruits such as the papaya, to illustrate another aspect of this problem it has been found that unless fruits show some evidence of yellow (ripening) colour on harvesting, they will not ripen properly later. In tomatoes, it is known that fruits picked when they show some pink coloration ripen to a product of superior quality than do those picked full grown but green. There is the further possibility that fruit harvested at different maturities may require different storage conditions.

Summarising these several points, it may be said that harvesting at the correct stage of maturity bears directly on the success with which subsequent refrigerated storage will be attended.

Rapid Cooling. As a rule, in handling tropical fruits, it is desirable that the time between reaping and placing them in cold storage should be curtailed to the minimum, as it is during the period of exposure to tropical temperatures that fungi make a rapid initial penetration which markedly affects the subsequent progress of rotting. As a rule the ripening of fully-grown fruits at tropical temperatures tends to be very rapid, after which senescence and fungal rotting quickly follow. Undue exposure prior to cold storage may therefore considerably shorten the anticipated storage life. This is particularly true of fruits such as the banana and mango. On the other hand, in grapefruit and oranges where changes take place more slowly the need is considerably less urgent from the point of view of preserving the quality of the fruit but still exists if fungal wastage is to be minimized.

While quick handling is usually desirable there are circumstances in which some delay is advisable. Thus, with citrus fruits which have been picked in a highly turgid condition, it is sometimes advisable as already indicated, that a quailing or curing period of suitable duration should be allowed to minimize the tendency to superficial bruising and the concomitant fungal wastage.

Preservation by Cold Storage. In the tropics, the past forty years have witnessed an increasing utilization of refrigeration for effecting the overseas transport of fruits and vegetables. Nor can it be doubted that there still remains a much wider field of usefulness for refrigeration. The very extensive and valuable industry in bananas from the west Indies, Central and South America has only been rendered possible through the provision of refrigerated shipping. The developing citrus industry, as also minor industries in mangoes, avocados, tomatoes, pineapples, passion fruits, and vegetables of different kinds, which can be produced abundantly and cheaply in the tropics, will in turn be largely, and in some instances, entirely, depend for their continued development and success on the provision of pre-cooling stations and of adequately equipped refrigerated ships. With regard to the latter it may be said that the absence of suitable transport facilities has been, and still is, the chief obstacle to the wider utilization of tropical produce on overseas markets.

It has been, that, if not held at suitably low temperature the ripening of tropical fruits and subsequent onset of wastage take place very rapidly. Accordingly, the problem is primarily one of arresting or retarding the progress of ripening without injuring the fruit. To do this to the best advantage it is essential that the physiological processes involved should be clearly understood. As the vegetable commodities under consideration are still alive, they require cold storage conditions which will permit of approximately normal though retarded maturation, so that the appearance, flavour, texture, aroma, and other qualities for which they are prized, will be preserved. The work of the investigator of fruit transport problems in the tropics, as elsewhere, is therefore principally physiological in nature, so that he may use to the best advantage the practical means which the refrigerating engineer has, or can, put at his disposal. In general, the equipment and design of refrigerated holds or cold stores for tropical fruits should be such as to permit of rapid cooling, the maintenance of steady temperature, humidity, and if necessary, gas concentrations optimal for the fruit in question.

Of recent years there has been a strong tendency to raise the storage temperatures recommended, this having been especially marked in the case of grapefruit where 'pitting' (chil blemishing) has in the past constituted a large proportion of

the wastage. Whereas formerly temperature below 40° F were frequently employed, the present tendency is to use 45° F. or higher. Such higher temperatures are important from the point of view of permitting two forms of wastage to occur at enhanced rates—blemishing due to desiccation and rotting by fungi. Further emphasis is thus put upon rapid cooling and higher humidity.

If an arbitrary and incomplete distinction may be drawn between 'cool storage' and 'cold storage', it will be found that the greater number of tropical fruits require to be carried in 'cool' storage (e. g. avocados, 45° F mangoes and tomatoes, 47·5° F. grapefruit. oranges and limes, 45 to 50° F. Gros Michel bananas, 53° F. Congo and Lacatan bananas, 56 to 58° F. papaws, 60° F., etc.) if chilling injuries, are to be avoided. In that too low a temperature may give rise to specific types of physiological injury, to failure to ripen, and to loss of resistance to fungal pathogens already present in the tissues as latent or dormant infections, it will be apparent that the location of thermometers is of considerable importance, and the relationship which exists between the air delivery temperatures and those which are present in the vicinity of the fruit nearest the inlet must be known in order to avoid chilling. The constructional arrangements within holds or storage rooms must permit of uniform distribution of air and consequently of refrigeration. Provided fruit is charged into the holds in good condition, and at the correct stage of maturity its maintainance in good conditions is then the direct responsibility of the refrigerating engineer and indirectly of those responsible for the design and type of equipment installed.

In large fruit industries, with consistent all the year round production, as in the banana industry, whole fleets of ships are employed and refrigeration equipment, with minor variations, has become standardized, i. e., battery equipment permitting of rapid cooling and subsequently of a sufficiently rapid circulation of air at 53°F. in the holds. But with commodities where production is seasonal, adequately equipped shipping is not always available, and instances are known where, for example, grapefruit and oranges have had to be carried as non-refrigerated cargo or in grid-cooled holds, with concomitant danger of enhanced fungal wastage or the production of chilling injury. A major difficulty, where small consignments of fruits, e. g. mangoes, avocados, etc., have to be carried at special temperature, is that small refrigerated holds are seldom provided in the construction of the modern refrigerated ship.

From the purely commercial point of view, the smallness of the initial consignments offered, and the special temperature required by different commodities, present serious obstacles. Yet it is during those preliminary shipments when the fruit must be landed in such a state as to impress brokers and potential purchasers that special refrigeration service is most essential. The provision of some small refrigerated chambers, in addition to the larger refrigerated holds, would provide the ideal solution to this problem. In making this suggestion, it is realized that initial constructional costs would be considerably increased and that supervision of cargoes would also have to be extended.

Both in respect of the normal physiology of the fruit, and the biology of its pathogens, the maintenance of correct humidity relationships within the holds is of very considerable importance. This conclusion is drawn from a number of instances in which the questions of humidity and water-relations have presented themselves for consideration; it must be admitted, however, that no final statements of the exact conditions required in different instances can yet be made. But, in general, it may be said of relative humidity within holds or storage rooms ; (a) that it should not be so low as to allow of serious loss in weight or modify the appearance and maturation of the fruit during the storage period ; b) that it should not be so high as to promote the superficial growth of fungal hyphae ; and (c) that localized condensation within the cargo stack must be

avoided. The question of the need for improved humidity control is now being urged on all sides by biologists; in its physical and manipulative aspects it is also being closely studied by physicists and engineers, and there seems little doubt that the future will be marked by interesting and valuable innovations.

Special methods of packing may call for modifications in the internal arrangements of holds and in methods of stowage. Thus, whereas the 'naked' stowage of Gros Michel bananas permits of easy access of cold air to the individual fingers a very different situation arises in the case of the Congo (Poyo banana as presently exported in large quantities from French West Indian colonies. This variety, having a more delicate and easily bruised skin than the Gros Michel is carefully padded and packed in a double envelope of paper with an intermediate layer of straw. On being stowed, these packages, particularly when subjected to the weight of the superimposed fruit, tend to form a compact mass of cargo, with the result that the interstices by which air can pass may be greatly diminished. To compensate for this the present tendency is to deliver air to the holds at undesirably low temperatures, with the result that whereas centrally placed bunches may still remain inadequately refrigerated, marginal bunches tend to be chilled. It is open to doubt whether a vertical distribution of air would effect a sufficiently good penetration of each closely packed cargo.

With particular reference to delicate exotic fruits, very considerable possibilities lie in improved overseas transport through the use of (a) small, specially equipped ships plying frequently, and (b) transport by fast ships whereby higher storage temperatures could be employed, with the desirable result that the pristine qualities of the fruit would tend to be less modified than during more prolonged storage at lower temperatures.

Tropical Pre-cooling Stations and Cold Stores. In any agricultural scheme involving the handling of fruits and vegetables in large quantities, the rational application of refrigeration should not be neglected. So far, both as a means of conserving locally produced supplies for home consumption and to facilitate export industries, comparatively little use has been made of refrigeration in the tropics; with some notable exceptions, one cannot escape the impression that the possibilities of refrigeration have to a large extent been overlooked or neglected through lack of knowledge, or, in some instances, fear of the expenditure involved. Still, the ideas are gaining a foothold and the need for local pre-cooling and holding stations is beginning to be appreciated to an increasing extent. The special problems arising in relation to the planning, construction and equipment of cold storage accommodation adapted to different tropical conditions, and to local agricultural and social requirements, will undoubtedly provide great opportunities for refrigerating engineers in the not distant future. Here it should be emphasized that although the basic scientific principles are the same thoughout, the special conditions prevailing in different tropical regions present problems that cannot be satisfactorily solved by experience in temperate countries alone. Indeed, it would appear that there is ample scope for a commission to visit the tropics and to consider the special refrigeration requirements in respect of site, construction, insulation and equipment of the ideal pre-cooling and holding station. In this respect the Union of South Africa is giving a valuable lead which, one would like to see followed elsewhere.

In the humid tropics fruit that has been held in precooling station is liable to 'sweating' (i. e., condensation of moisture) during the period of transference to the ship's hold. In some instance, where ships are unable to come alongside, the commodity may have to be exposed for serveral hours. So far there is no definite evidence that fruit suffers to any marked degree as a result of the changes involved, e. g., sharp rise in temperature and deposition of moisture on the wrappers, provided such moisture is allowed to evaporate fairly rapidly on

shipboard, but it is evident that from the standpoint of the refrigerating engineer such arrangements are very unsatisfactory. These conditions are by no means uncommon in tropical ports. Although there is considerable scope for refrigerating engineers to devise ways and means of solving these special problems, it is probable that the expenditure involved would tend to be disproportionately high.

For the most part, ideas regarding the advantages of local cold stores are only now beginning to be appreciated in the tropics. As a rule the initial capital expenditure and high running costs, and the absence of refrigerating engineers to give the necessary supervision, are the factors which limit schemes whose operation would eventually benefit the whole community to an extent that would be difficult to assess. In this way the value of the short but highly productive cropping period, characteristic of many tropical crops, can be greatly increased, in that "glut" periods and their attendant low prices, can be eliminated, and produce of good quality can be made available over a very considerably extended period. The most economical use of local cold stores, where the harvest period for any one crop is short, is a matter for careful consideration by the authorities involved, departments of agriculture and planters in particular via co-operative marketing.

Post Storage and Ripening. When tropical fruits are removed from cold storage to higher temperatures, ripening takes place rapidly, and serious wastage may soon be sustained. To a considerable extent, the latter undesirable feature could be overcome by holding the fruit at a suitable temperature until required for actual consumption. In countries where refrigeration has been more or less thoroughly domesticated, such special post transport treatment is feasible and is, in fact, an established scheme. In many countries, however, refrigeration whether in warehouses or small stores, is still regarded as an unwarranted and additional expense; until some modification is made in this point of view considerable wastage must be expected during the retailing of delicate tropical fruits In brief, the outlook for exotic fruits on distant markets will be determined among other factors, by the extent to which the use of refrigeration become domesticated. The recent development in the United Kingdom of the retailing of frozen fruit and vegetables also points to the need for investigation of this method on tropical fruits.

Some fruits, in particular the banana, undergo special ripening treatment-involving temperature and humidity control on being removed from the ships' holds: the improvements of ripening technique opens up a wide and useful field for physiological investigation.

Concluding Observations. To those who are occupied with questions pertaining to the storage and transpot of tropical fruits it becomes increasingly evident how extensive is the field that awaits the attention of the investigator, Problems such as those of the effect of volatiles, gas storage, transport of mixed consignments, quick freezing, etc., are practically or, in some instances entirely untouched.

Refrigeration applied to agricultural industries in the tropics does not stand alone but should be treated as an integral part of the general business organization of the community. Some words spoken by the President of the British Association of Refrigeration (1938) are apposite to the occasion: "If we are adequately to conserve our supplies, if we are to protect our agricultural heritage and if we desire to secure what has frequently been termed the quantitative regulation of market supplies of perishable foodstuffs, then it would seem to me that the science of refrigeration must be embraced to a much greater degree than it is to-day." *Journal of the Royal Society of Arts.*

ABSTRACTS

Influence of Boron on Flower-bud Development in Cotton—Holley K. T. & T. G. Dublin: *Jour. Agri. Res.* 59: (1939) 541-545. Experiments conducted at the Georgia Experimental Station emphasise the importance of boron in flower-bud development in cotton. The vegetative vitality of plants at different boron levels were not dissimilar till 8-9 weeks. The initiation of flower bud production also seemed independent of the boron levels. The flower buds of plants at lower boran level became chlorotic and were shed. In such plants, the vegetative buds were malformed at advanced stages of growth. (E. R. G.)

A further report on root forming substances used for propagation purposes:— M. A. H. Tinker, & C. H. Unwin: *Journal of the Royal Horticultural Society* XXIV: 554. Systematic experiments were carried out by the authors to test the efficacy of certain synthetic compounds and proprietary substances, reported to be beneficial in accelerating root formation in cuttings used for plant propagation. About seventeen substances were tested, using different concentrations and cuttings usually found refractory root formers. The most satisfactory substances were found to be (a) indolylbutyric acid and (b) napthyl acetic acid. Other factors found influencing root formation are the age of the parent, young tissues responding better; similarly lateral branches have proved superior to terminal cuttings. The presence of traces of vitamin B. (aneurin) in the salts used definitely accelerated root development. (E. R. G.)

Organic and inorganic manures—Their relative effectiveness—Sir John Russell, *The Scottish Journal of Agriculture*, Vol. XXII, page 319.

The oldest and best known method of manuring the land is to give it farmyard manure but the chief trouble is that there is not enough of it. Liebig suggested that the elements of plant food could be supplied by simple inorganic salts, known as artificial fertilisers. Lawes at Rothamsted showed how to do this in practice. The farmyard manure besides supplying the standard plant food, keeps up the supply of the organic matter in the soil, improves the physical properties of the soil, & influences the moisture content of the soil.

Claims are made that crops grown with farmyard manure are sometimes said to be healthier, more resistant to pests and diseases and of better nutritive value for animals and men than those grown with artificial fertilisers, but there is no evidence for these statements. In making comparisons, it is necessary that the artificial fertilisers should be complete, including not only the standard plant foods but also those special minor elements as boron, zinc, manganese, iron &c.

The following organic substances viz. poultry manure, guano, meat and bone manures, fish manures, oil cake manure &c., supply plant food and the nitrogen in some of them is better than in farmyard manure. Waste vegetable matter can be converted into a useful manure by composting. The essential features are that the supply of moisture, of nitrogen and of phosphate should be adequate for the micro-organisms.

Two sources of organic manure are, however, not yet sufficiently used in Great Britain—town refuse and sewage. Town refuse contains nearly as much nitrogen as farmyard manure. Sewage presents a more difficult problem as there is no good method of putting it on to the land—part can be returned as sewage sludge but most is lost. As a maker of manure the human being is almost devoid of agricultural value. (K. K. M.)

EXTRACTS

Care of growing pullets. Any special attention or care given to pullets during their growing stage will be well repaid by greater production when they come into profit. The main points in management which ensure profitable pullets are: Perching early, separation of sexes, small units feeding, and sanitation. Pullets should be taught to perch as soon as possible after they have been removed from the brooder. The earlier they become accustomed to perching, the more they spread at night. This prevents crowding and ensures a good air supply for all. The separation of sexes as soon as the males can be distinguished, gives them a much better change of making good development. Small units also assist in their development and decreases the percentage of stunted pullets, which is the usual result when large numbers are housed together. It is advisable not to house more than 100 pullets in any one unit.

Feeding also is important. The ration should be correctly balanced and the birds given as much food as they will eat. The birds should be given as much mash as they consume in about 20 minutes; if they require more, it should be supplied. It is advisable to give two meals of wet mash, one early in the morning and the other at midday. In no circumstances, should wet mash be left lying about as it sours rapidly and puts the birds off their food. Dry mash hoppers should be kept well filled and always open. The feeding troughs of both systems should be long enough to provide ample feeding space. Lack of sufficient feeding space is a very common error in dry mash feeding. At least one foot of space should be allowed for each ten birds.

Green feed may be supplied with the midday meal, unless the birds have access to a well-grassed run. Wet mash should form the bulk of the midday meal unless the dry mash method is used. In dry mash feeding a small quantity of mash mixed with the greens will tend to increase the consumption of greenstuff. As an evening meal, the pullets should be given as much grains as they will consume.

Clean, cool, fresh water should always be supplied daily, and the drinking vessels should be kept in a shaded position. Coarse sand, shell grit, and charcoal should always be available and kept in suitable containers. Each of these materials has an important influence as an aid to digestion and assimilation of food, and is therefore, invaluable in maintaining health in the flock.

Sanitation also is important and covers the regular cleaning of pullets pens. Wet patches should not be allowed to surround the drinking vessels, and the treatment of perches with creosote to prevent an invasion of blood-sucking parasites should not be overlooked. (*Queensland Agri. Jour.* Vol. 52: October 1939.)

A method of weed Eradication. Under the title, "Biological Eradication of Kans (*Saccharum spontaneum*) in field patches" G. C. Lambe and Y. D. Wad of the Institute of Plant Industry, Indore, Central India, draw attention to what appears to be a simple and efficient method of eradicating troublesome weeds (*Agric. and Livestock in India*, 8, Pt, IV), The method adopted was to cover, by means of thick mulch of green material such as sunn-hemp, green grass or even green weed growth removed from fields, the patches of land overgrown with the particular weed desired to be destroyed, and allow the mulch to remain through the rainy season. At the end of this period it is found that the decomposing green materials had acted on the root system of the weeds under the rotting cover green mantle and had effectively killed it. In addition to such destruction, the treated land is also said to have increased in fertility. Wheat and cotton grown

on such treated plots gave significantly higher yields than the controls and in the case of wheat the quality also greatly improved. The improvement related mainly to the total nitrogen and gluten content which were 2·07 and 11·53 per cent respectively as against 1·65 and 8·04 per cent in the control.

The treated plots showed a higher content of organic matter in the upper zones of their soils than the controls and it is surmised that the better quality of the wheat in the treated plots may be due to this increased organic matter content. The essential feature of the method is the use of green material as such in contradiction with dry material like straw or *bhusa* which are found to be ineffective. The method deserves to be tried in the case of other difficult weeds such as the *Hariali* grass (*Cynodon dactlylon*) of the black cotton soils, a weed which greatly reduces cotton yields and involves much cost and labour to eradicate and is seldom permanently removed even then. The touch-me-not. (*Mimosa pudica*) is another such weed against which cu'tural chemical and other methods are in practice out of the question and a suitable adaptation of this new method deserves a trial. (*The Planters' Gazette and Annual*).

Treatment of Seed Maize. The difficulty often experienced in obtaining satisfactory crop stands more particularly in the early sowings of maize because of crows and currawongs developing an appetite for germinating grain and seedling plants-can be largely overcome by adopting the undermentioned pre-seedling coal tar method of seed treatment.

The procedure is as follows:— Warm a small quantity of coal tar slowly until it tests to a string like horse hair consistency. Place the seed maize in a large shallow vessel and wet it with warm water for a few minutes and then drain. Spread over the warm moistened grain 1½ to 2 tablespoonfuls of prepared tar per bushel and stir immediately and continuously until each kernel comes in contact with the tar and assumes a sooty appearance. Spread the grain out and expose it to dry. The addition of a handful of sulphur to each bushel of grain will assist in a smooth run through the planter. (*Queensland Agri. Jour.* 52: October 1939.)

Wanted a Dictator ? "India needs a dictator". This has been repeated in our hearing again and again that we have been forced at least to consider whether such a statement has any truth in it. The more we consider it however, the more we feel inclined to agree with it. For, as we look around us, we see that the progress is too slow. In Agriculture, and we believe, in most other matters, India seems to need a strong hand. Crops in Government farms or in farms connected with agricultural institutions seem definitely to be superior to the crops of the villagers just across the road. But many of these villagers do not seem to want to change either their seeds or their methods of cultivation both of which having been handed to them by their fathers and their grand-fathers. A cow in an agricultural institution may be giving 40 to 50 lbs. of milk a day, but that of the villagers is only giving 4 to 5 lbs. per day; yet how many of such villagers are seriously considering the improvement of their cows by careful breeding and selection. A man using modern implements can now easily take care of 20 to 50 acres of land, whereas one using a *desi* (country made) plough can take care of 5 to 10 acres only. Can any one, therefore, deny the fact that if a strong hand is used the progress in our rural areas would be much more rapid than it is now? The above, however, do not seem to us to be so pressing as some other problems in agriculture.

One of the things we would like to see the Government authorities adopt as part of their immediate programme is the control of erosion. It has been pointed

out again and again that erosion is robbing our nation of our very life blood as this process impoverishes the soil to such an extent that a field once considered to be rich is sooner or later depleted of its fertility. In order, therefore, that the Nation be no longer robbed of its heritage given to us by God, we plead that this waste in the form of soil carried down to the ocean be stopped at once. A country-wide survey of agricultural lands in the province in order to find out where immediate steps should be taken to prevent this loss is, to our minds very necessary for not only keeping up the fertility of our lands, but also for reclaiming those that are almost beyond hope of any possibility for reclamation. Such steps, we have no doubt, will help to increase the productive power of the agricultural lands in this country, a thing sorely needed when a good part of our agricultural population go from one day to another without sufficient food. For it is indeed painful to see, as one goes around in these provinces, the dreadful loss that is caused to the country by man's attitude of indifferecne to one of the most important factors of production, namely, land. Lands that should be capable of producing the best kind of wheat that there is anywhere in the world is now only capable of producing *Bajra*, a millet, so poor that it does not even pay the cost of producing it. Some lands have been rendered almost completely useless by erosion that only grasses of the very poorest kind would now grow on them. It is high time, therefore, that something more be done about it sooner or later, besides the very feeble attempts made by the Forest departments for attacking this very serious problem. (*The Allahabad Farmer* Vol. XIII No. 2 March 1939 pages 53 to 55).

Gleanings.

Paradichlorobenzene. News of a really effective insecticide is always welcome to those plagued with *poochies*,* as most of us are in South India. In spite of its formidable name,—Paradichlorobenzene is a simple white crystal substance easy to handle. It is much stronger than napthalene and smaller quantities are required. Not only does it keep away insects, but we learn it actually destroys their eggs and larvae. To prevent too rapid evaporation it may be placed in small cloth bags, or else in wide neck bottles or cigarette tins with holes punched in their lids, and then kept in cupboards, almirahs, etc. We understand that paradichlorobenzene is put up in 1 lb. and 5 lbs. by the Imperial Chemical Industries. (*The Planters' Chronicle*, Vol, XXXI, No. 24).

Use of Blood as a Fertiliser. Blood is fairly rich in nitrogen, but requires to be decomposed before being added to the soil. If in a liquid condition, the blood should be absorbed in sand, soil or litter, and made into a compost with soil and manure or any waste vegetable material, such as leaves, lawn clippings, etc., which may be available.

If the blood is clotted it should be broken up and made into a compost in the same way. The compost should be protected from rain and forked over from time to time. At the end of a couple of months, it should be well dug into the soil where it will supply nitrogen in a readily available form. *Agri. Gaz.* Vol. 50: (November 1939).

Mange in Pigs. Caused by a minute, worm-like mite which lives in the hair follicles and sweat glands of the skin, the condition described as demodectic mange in pigs is one which the pig raiser ought to know all about because its presence sometimes results in the degrading of carcases, especially of those submitted for export. The mites are microscopic in size, measuring only one hundredth of an inch in length. The lesions of demodectic mange first appear,

* Tamil word for insects. Ed. M. A. J.

as a rule on the snout, eyelids, elbows, and knees. In the initial stage the areas attacked have a reddened, scurfy appearance with numerous small, hard nodules scattered over them. These become infected with bacteria and begin to ooze pus and serum. The disease gradually spreads over the throat, breast, abdomen, and elsewhere where the skin is soft and thin. In its early stages, demodectic mange may be checked by frequent applications of crude oil. The disease, however, is very difficult to cope with, and once it appears, it is best to get rid of infected animals and to isolate all other animals which have been in contact with them for at least a fortnight. In addition, the sites should be cleaned out thoroughly with boiling water and soda and then disinfected. *Queensland Agri. Jour.* October 1939.

Crop & Trade Reports.

Subject:—Statistics—Crop--Sugarcane—1939—Third or Final Report. The average of the areas under sugarcane in the Madras Province during the five years ending 1937-38 has represented 2·8 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to 25th December 1939 is estimated at 132,010 acres. When compared with the corresponding estimate of 96,930 acres for the previous year and the actual area of 98,262 acres according to the Season and Crop Report, the present estimate reveals an increase of 36 2 per cent and 34·3 per cent respectively. The estimate of the previous year fell short of the actual area by 1·4 per cent.

The present estimate of area exceeds the second forecast by 9,270 acres. The excess occurs mainly in Vizagapatam, Kistna, Salem, Coimbatore and Trichinopoly.

The increase in area in comparison with the actual area of 1938 as per Season and Crop Report occurs in all districts outside Tinnevelly and Malabar and is attributed to favourable prices prevailing for jaggery. The increase is marked in Vizagapatam (plus 4180 acres), Bellary (plus 5,050 acres), South Arcot (plus 3,780 acres) and the Central districts (plus 16,450 acres). The area estimated for Bellary, Cuddapah, South Arcot, Coimbatore, Trichinopoly, Tanjore and South Kanara is the highest reported in recent years. The present estimate includes an area of 6,700 acres under ratoon sugarcane in the districts of Vizagapatam (800 acres), East Godavari (3,000 acres), West Godavari (700 acres), Bellary (700 acres), Chingleput (80 acres), South Arcot (400 acres), Chittoor (1,000 acres), Coimbatore (100 acres), Trichinopoly (590 acres). Tanjore (200 acres) and Malabar (20 acres).

5. The harvest has just commenced and yields below normal are expected in all districts outside Anantapur, Cuddapah, Nellore, Salem, Madura and Ramnad where the yield is expected to be normal. The seasonal factor for the Province is estimated at 95 per cent of the average as against 97 per cent in the previous year according to the Season and Crop Report. On this basis, the yield is estimated at 358,140 tons of jaggery as against 261,130 tons estimated in January 1939, an increase of 37·2 per cent and as against 273,860 tons, estimated in the Season and Crop Report of the previous year, the increase in this case amounting to 30·8 per cent.

The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 22nd January 1940 was Rs. 9—14—0 in Adoni, Rs. 7—2—0 in Vizianagaram, Rs. 7—1—0 in Erode, Rs. 6-14-0 in Chittoor, Rs. 6—6—0 in Mangalore, Rs. 6—1—0 in Cuddalore, Rs. 5—15—0 in

Vizagapatam, Rs. 5—14—0 in Coimbatore, Rs. 5—12—0 in Cocanada, Rs. 5—9—0 in Rajahmundry, Rs. 5—2—0 in Bellary and Vellore, Rs. 4—15—0 in Salem, and Rs. 4—7—0 in Trichinopoly. When compared with the prices published in the last report, i. e., those which prevailed on 4th December 1939 these prices reveal a rise of approximately 12 per cent. in Coimbatore and Mangalore, two per cent, in Erode and one per cent. in Vizianagaram and a fall of approximately 35 per cent in Vizagapatam, 34 per cent. in Salem, 31 per cent. in Trichinopoly, 29 per cent. in Vellore, 27 per cent. in Bellary, 23 per cent. in Rajahmundry, 19 per cent. in Cuddalore and 12 per cent. in Cocanada, the prices remaining stationary in Adoni and Chittoor.

Subject :—Statistics—Paddy 1939—40.—Final forecast Report. The average of the areas under paddy in the Madras Province during thefive years ending 1937—38, has represented 13·4 percent of the total area under paddy in India.

The area sown with paddy in 1939—40 is estimated at 9,614 000 acres as against 9,943,000 acres for the corresponding period of the previous year and the finally recorded area of 9,844, 388 acres in 1938-39. The present estimate falls short of the final area of the previous year by 2·3 per cent and of the area of 10,200,160 acres in a normal year by 5·7 per cent.

1,128,000 acres have been reported as sown since the last December forecast was issued. The extent so sown was large in the South (320,000 acres), the Circars (244,000 acres), the Central districts (235,000 acres) and South Arcot (133,000 acres). The area sown in December and January was greater than that sown in the corresponding period of the previous year by 165,000 acres or by 17·1 per cent.

The area under second crop paddy is expected to be below normal, though slightly greater than last year, owing to the failure of rains in December and January.

The harvest of the main crop of paddy is in progress.

The crop was affected to some extent by the heavy rains and floods in November 1939 in parts of the districts of East Godavari, West Godavari, Kistna and Tanjore. The crop was also affected to some extent by drought in the other important paddy growing districts outside the West Coast. Attacks by insects have been reported from parts of the districts of North Arcot and Tanjore. The yield is expected to be normal in Kurnool, Bellary, Cuddapah, Salem, Madura, Malabar and the Nilgiris and below normal in the other districts. The seasonal factor for the Province works out to 93 per cent of the average as against 83 per cent in the Season and Crop Report of the previous year. On this basis, the yield works out to 89,258,000 cwt. of cleaned rice. This represents an increase of 7,253,000 cwt., of cleaned rice or 8·8 per cent when compared with the estimate of 82,005,000 cwt., of cleaned rice in the Season and Crop Report of the previous year. The yield in an average year is estimated at 102,007,000 cwt. of cleaned rice.

The wholesale price of paddy, second sort, per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 12th February 1940 was Rs. 2—14—0 in Tinnevelly, Rs. 2—13—0 in Rajamundry, Rs. 2—12—0 in Vizianagaram and Chittoor, Rs. 2—11—0 in Virudhunagar, Rs. 2—9—0 in Ellore Guntur, and Madura, Rs. 2—8—0 in Bezwada, Vellore and Hindupur, Rs. 2—7—0 in Cocanada, Rs. 2—5—0 in Cuddalore and Trichinopoly, Rs. 2—4—0 in Anantapur and Conjeevaram Rs. 2—0—0 in Kumbakonam and Rs. 1—15—0 in Nagapatam When compared with the prices published in the last report, i. e., those which prevailed on 8th January 1940. the prices reveal a rise of approximately 13 per cent in Conjeeveram, eight per cent in Guntur, five per cent in Vizianagaram, Rajahmundry, Ellore, Hindupur and Tinnevelly and three per cent in Bezwada

and a fall of aproximately 23 per cent in Anantapur, 20 per cent in Kumbakonam, 15 per cent in Madura, 10 per cent in Chittoor, five per cent in Vellore, three per cent in Cocanada, Trichinopoly and Nagapatam and two per cent in Virudhunagar, the prices remaining stationary in Cuddalore.

Sub:—Statistics—Crop—Gingelly—1939-'40—Intermediate condition report. Sowings of late gingelly are in progress in most districts and the germination is fairly good.

The wholesale price of gingelly per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 5th February 1940 was Rs. 7—8—0 in Cocanada, Rs. 7 in Vizagapatam, Rs. 6—14—0 in Tinnevelly, Rs. 6—9—0 in Trichinopoly, Rs. 6—8—0 in Vizianagaram, Rs. 6—6—0 in Salem, Rs. 6—3—0 in Tuticorin, Rs. 6—1—0 in Ellore, Rs. 5—15—0 in Rajahmundry and Cuddalore. When compared with the prices published in the last report, i. e., those which prevailed on 8th January 1940, these prices reveal a rise of approximately 17 per cent in Salem, 15 per cent in Tinnevelly, and 11 per cent in Trichinopoly and a fall of approximately 6 per cent in Ellore and 5 per cent in Vizagapatam and Rajahmundry, the prices remaining stationary in Vizianagaram, Cocanada, Cuddalore and Tuticorin.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st to 9th February 1940 amounted to 2,847 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939--40. The receipts in the corresponding period of the previous year were 4,785 bales. 4,689 bales mainly of pressed cotton were received at spinning mills and 431 bales were exported by sea while 324 bales were imported by sea from Karachi.

Market Reports

TIRUVOTTIUR MILCH CATTLE MARKET

Market Report No. 3 of 1940.

Madras, Friday the 19th January 1940.

Due to Pongal festival, the arrivals of milch cattle were very poor at the market and consequently there was no brisk trade in either cows or buffaloes. Prices remain stationary.

The stock movements were as follows;—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance at end.
Cows-Ongole	150	49	81	118
Buffaloes-country	109	55	58	106

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—4 ,, ,,	60	80
Others			
Cows-cross-bred		130	180

Market Report No. 4 of 1940.

Madras, Friday the 26th January 1940.

The Pongal festival being over, the market has regained its activity with increased arrivals and sales of stock. Cows are in better demand due to slight improvement in fodder supply. Prices especially of cows have an upward tendency.

	Stock at Commencement.	Arrivals during the week.	Sales during the week.	Balance at end.
Cows-Ongole	118	150	100	168
Buffaloes-Country	106	196	111	191

Prices.

Age.	Yield of milk.	Prices ranging. From	To
		Rs.	Rs.
Cows—Ongole			
1st and 2nd calving	2—3 Madras Measures	85	95
	3—4 ,, ,,	95	125
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes—Country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—4 ,, ,,	60	80
Others.			
Cows-cross-bred		No stock.	

Market Report No. 5/40.

Madras, Friday the 2nd February 1940.

Country buffaloes continued to arrive in large numbers and the stocks of both cows and buffaloes at the market have increased. Due to heavy arrivals, the prices of buffaloes have slightly decreased.

The following gives the stock movements during the week ending 2nd February 1940.

	Stock at commencement	Arrivals during the week	Sales during the week	Balance at end
Cows...Ongole	168	146	137	177
Buffaloes...Country	191	208	169	230

Prices.

Age	Yield of milk	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	85	95
	3—4 ,, ,,	95	125
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-Country			
1st and 2nd calving	2—3 ,, ,,	50	65
	3—4 ,, ,,	60	95
3rd and 4th calving	2—3 ,, ,,	45	55
	3—4 ,, ,,	55	75
Others.			
Cows-cross-bred		130	180

Market Report No. 6/40.

Madras, Friday the 9th February 1940.

The arrivals of cows and buffaloes continued to be good during the week and better type of cattle are now available at the market than in the previous weeks. Prices are stationary.

The following gives the stock movements during the week ending 9th February 1940.

	Stock at Commencement.	Arrivals during the week.	Sales during the week.	Balance at end.
Cows-Ongole	177	167	144	200
Buffaloes-Country	230	179	179	230

Prices.

Age	Milk yield.	Prices ranging. From Rs.	To Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures.	85	95
	3—4 ,, ,,	95	125
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-Country			
1st and 2nd Calving	2—3 ,, ,,	50	65
	3—4 ,, ,,	65	95
3rd and 4th calving	2—3 ,, ,,	45	55
	3—4 ,, ,,	55	75
Others			
Cows-cross-bred		130	180

Market Report No. 7/40.

Madras, Friday the 16th February 1940.

The arrivals of cows from the Ongole tract have slightly declined while buffaloes have arrived in more numbers. Better type of cattle are still available at the market and prices are stationary.

The following gives the stock movements during the week ending 16th February 1940.

	Stock at Commencement	Arrivals during the week.	Sales during the week.	Balance at end.
Cows-Ongole	200	105	110	195
Buffaloes-Country	230	147	130	147

Prices.

Age	Milk yield	Prices ranging From Rs.	To Rs.
Cows-Ongole.:			
1st and 2nd calving	2—3 Madras Measures.	85	95
	3—4 ,, ,,	95	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-Country.			
1st and 2nd calving	2—3 ,, ,,	50	65
	3—4 ,, ,,	65	95
3rd and 4th calving	2—3 ,, ,,	45	55
	3—4 ,, ,,	55	75
Others.			
Cows-cross bred		130	180

(1 Madras Measure of Milk=4 lb.)

College and Estate News.

Students' Corner;— *Students' Club activities:—Games:*— The following inter-tutorial cricket matches were played:— C. R. Srinivasa Ayyangar's wards won against P. V. Ramiah's wards. C. R. Srinivasa Ayyangar's wards put up a total of 155 runs, Krishnan 53, M. R. M. Punja 44, S. V. Srinivasan 5 for 74. P. V. Ramiah's wards gathered 83 runs, M. Ali-khan 54, K. S. Ramaswami 14, M. R. M. Punja 5 for 21.

K. M. Thomas' wards won against C. Narasimha Ayyangar's wards. K. M Thomas' wards—70 for 4, Shankara Rao 31 and T. Chellappa 14. C. Narasimha Ayyangar's wards were all out for 60, Narasimhamurthi alone reaching double digits—13,—K. M. Somanna 6 for 14.

C. R. Srinivasa Ayyangar's wards won against K. M. Thomas' wards by 11 runs. C. R. Srinivasa Ayyangar's wards 142, Krishnan 84, Bhaskara Reddy 23 and Maduram 17, Somanna 6 for 57, Kamath 3 for 37. K. M. Thomas' wards—131. Nageshwara Rao 20, T. Chellappa 24, Somanna 62, M. R. M. Punja 4 for 24, Bhaskara Reddy 2 for 11.

Club Day Victory Cup Tournament. *Foot-Ball*:—In this series, the first match was played between B. Sc. III and B. Sc. II in which the former won by 2 goals to 1.

The third years were subsequently defeated by 1st years by 1 goal to nil.

Hockey. Class III lost to class II in their first encounter by 1 goal to 3. The 1st years were defeated by IInd years by 1 goal to 2.

Cricket, B. Sc. III was defeated by B. Sc. II:— IIIrd years were all out for 76, Ayyappa 15, Srinivasan S. V. 4 for 43, and Bhaskara Reddy 3 for 3.

IInd years—107 for 8, S. V. Srinivasan 46, Kamath 27 not out.) The second years then met the 1st years and won by a margin of 32 runs. IInd years—123, Koulatlayya 31 not out, S. V. Srinivasan 19, Somanna 16, Radhakrishnan 6 for 56, 1st years—91, Krishnan 33, Shankera Rao 21, S. V. Srinivasan 17 for 33, Somanna 3 for 23. The Second years thus won the Victory cup for the year.

Other cricket matches. A friendly cricket match was played on 28—1—40 between C. Ramaswami's Eleven and Palghat Eleven at the Agricultural college grounds. Batting first, C. Ramaswami's Eleven scored 234 for 7 and declared their innings. C. Ramaswami 48, S. V. Srinivasan 108 retired. Padmanabhan 38. Rammohan 3 for 11, Narayanan 2 for 59.

The Palghat Eleven were all out for 158. Raghavan, P. M. 42, Ramamohan 21, Madhavan 21, Mukunda Rao 23, S. V. Srinivasa 4 for 41, Mukundan 2 for 8, C. Ramaswami 2 for 25.

The Agricultural college cricket team from Coimbatore captained by C. Ramaswami met and defeated the Salem Gymkhana by 35 runs on 11—2—40. The match was played on Manor House compound. Salem Gymkhana 142, MacHatton 37, K. N. Venkatachari, 28, T. Spittler 23, Kothandaraman 6 for 42, Somanna 2 for 29, Srinivasan S. V. 2 for 24.

Agricultural College 177, Babu, C. N. 53, C. Ramaswami, 46, R. Natesan 3 for 29, R. Spittler 3 for 64, R. Manickkam 2 for 24.

University Extension lectures. These lectures are arranged by the University of Madras for the benefit of rural workers engaged in social amelioration. A course of three lectures was delivered by Dr. J. J. De Valois, B. Sc., Principal, A. A. M. Agricultural Institute, Katpadi, at the Freeman Hall, Agricultural College, Coimbatore on the 26th and 27th of January 1940. Mr. R. C. Broadfoot presided

over the lectures. The subjects of the discourse were (1) Rural youth organisation (2) Rural Education and (3) The University and Rural life. The Lectures were illustrated with cinema films depicting the activities of 4 H—clubs and other social organizations in the United States of America.

M. Sc Degree:-- We are glad to note that the University of Madras has conferred the degree of M. Sc., on Mr. S. Sundaram B. A., B. Sc., Ag. Cotton Assistant, Koilpatti for his thesis on "The harmful effects of fodder cholam on the succeeding cotton crop". We offer our congratulations to Mr. Sundaram.

Agricultural College Officers' Club. In the General body meeting held on 20--2—40, the following office bearers were elected for the year 1940.

Sri. T. S. Ramasubramaniam,	President.
,, P. D. Karunakar	Vice-President.
,, P. Krishna Rao,	Secretary.
,, Balasubramania Mudaliar,	Treasurer.
Messrs. M. A. Sankara Ayyar, C. S. Krishnaswami and C. V. Nagarajan,	Committee Members.

Obituary.

The late Mr. S. Subramania Ayyar, We are sorry to record the sad demise at Kumbakonam of Mr. S. Subramania Ayyar, a retired member of our Department, Born in September 1873, he entered Government service on 9th October 1894 and served the department till 1927 for a periof of 33 years. He served for sometime (1919—1921) as an Assistant Director of Agriculture at Bellary.

We express our heartfelt condolences to the members of the bereaved family.

Mofussil News and Notes.

Anakapalle. Honey Week Celebration at the Agricultural Research Station, was celebrated with great enthusiasm and *eclat* on Sunday the 21st January 1940. An instructive show of all available bee-keeping appliances was put up, and Sri M. Lakshmikantam, B. Sc. (Ag.) staged a bee-keeping demonstration, followed by a lucid talk on "Apiculture as a successful cottage industry" The assembled agriculturists and 'elite' of the town appreciated the show, and evinced great interest in it. The meeting terminated with a discourse by the Superintendent Sri. K. Venkataraman, M. A. K. V.

Bezwada. At the invitation of Mr. P. Govinda Rao, B. Sc. Ag., Mycology Assistant in charge of the citrus disease control work at Bezwada, a meeting of citrus growers in the Bezwada taluk was held at the Pattamata library on Monday, the 29th January 1940. Over thirty growers were prensent. Mr. K. M. Thomas, Government Mycologist, Coimbatore addressed the gathering on the nature of the Citrus root disease occuring in the Kistna and Guntur districts, the pre-disposing causes and the methods of prevention and Control. This was followed up by a speech by Mr. Govinda Rao who explained to the audience the object of the new scheme of work started at Bezwada and the extent to which Government are prepared to help the growers. Mr. P. L. Narasimham, Agricultural Demonstrator, Bezwada also spoke and explained to the growers the advantages to be accrued from a general adoption of the control measures [illegible] A discussion followed as a result of which most of the garden

owners signified their willingness to adopt the measures and a dozen, offered to give their gardens for purposes of demonstration. The method of treatment now followed consists in the following :—

(1) Adoption of ring irrigation in place of flood irrigation.
(2) Cutting of drainage channels across the gardens.
(3) Examining the crown of roots and excision of diseased roots;
(4) Application of Copper sulphate incorporated around the trunk.
(5) Scraping of cankers on the roots and trunks and application of creosote oil.
and (6) Covering wounds on roots stem and branches with shelmac P. G. R.

Cocanada. An Agricultural Exhibition was held at Cocanada on a large scale from 20th to 22nd January 1940 by the Horticultural Exhibition Society. Various exhibits from the Agricultural Research Station at Samalkot and Maruteru and from the Agricultural Demonstrators in the division were obtained and exhibited. Entomological and Mycological specimens bee hives and honey were also exhibited by the Assistant to the Government Entomologist, of Samalkot. Lectures on various aspects of gardening and methods of propagation of fruit, and flower and vegetables were also delivered. D. H. R.

Kodur. The Kodur Chinese Grader which was recently devised at this Station with the help of a grant from the Marketing Section was demonstrated to the growers in a number of gardens by the Kodur Fruit Growers' Association. The usefulness of this cheap machine (costing less than Rs. 50) in grading sweet oranges has now been established, and the Association has already placed an order for the supply of two new machines. K. C. N.

Vadulur. An Agricultural Exhibition was held at Vadalur (Cuddalore Taluk) the resting place of Ramalinga Swamigal, during Thaipusam festival which attracted large crowd from South Arcot and the neighbouring districts. Lectures with the aid of magic lantern were delivered by Agricultural and Health Departments on this occasion. K. S. K.

28th. Indian Science Congress, Benares, January 1941.

Discussions in the Agricultural Section.

An announcement.

The Agricultural Sectional Committee proposes to hold Discussions on the following subjects during the next Session of the Indian Science Congress to be held at Benares early in January 1941. Scientific workers in India who desire to contribute papers to the above Discussions are requested to communicate with the undersigned. The Rules of the Indian Science Congress Association require that authors of such contributions should be members of the Association of some category.

Discussions.

1. Drought Resistance in Plants:
2. The need for the exploration of wild forms for the improvement of crops.
3. Quality in crops.

10th February 1940.
Indian Institute of Science,
Hebbal P. O. Bangalore.

C. N. Acharya,
Recorder,
Agricultural Section.

Weather Review—JANUARY 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·23	0·0
	Calingapatam	0·0	−0·29	0·0
	Vizagapatam	0·0	−0·46	0·0
	Anakapalli*	0·0	−0·27	0·0
	Samalkota*			
	Maruteru*	0·0	−0·04	0·0
	Cocanada	0·0	−0·19	0·0
	Masulipatam	0·0	−0·23	0·0
	Guntur*	0·0	−0·2	0·0
Ceded Dists.	Kurnool	0·0	−0·18	0·0
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·0	−0·02	0·0
	Siruguppa*	0·0	−0·09	0·0
	Bellary	0·0	−0·11	0·0
	Anantapur	0·0	−0·35	0·0
	Rentachintala	0·0		0·0
	Cuddapah	0·0	−0·43	0·0
	Anantharaju-pet*	0·0	−1·0	0·0
Carnatic	Nellore	0·1	−1·6	0·1
	Madras	0·1	−1·3	0·1
	Palur*	0·0	−1·9	0·0
	Tindivanam*	0·6	−1·0	0·6
	Cuddalore	0·3	−1·3	0·3
Central	Vellore	0·0	−1·49	0·0
	Salem	0·0	−0·31	0·0
	Coimbatore	0·0	−0·59	0·0
	Coimbatore A. C. & R. I.*	0·0	−0·70	0·0
	Trichinopoly	0·0	−0·68	0·0

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·0	−1·68	0·0
	Aduthurai*	0·15	−3·5	0·15
	Madura	0·0	−0·60	0·0
	Pamban	2·2	+0·07	2·2
	Koilpatti*			
	Palamkottah	0·0	−1·50	0·0
West Coast	Trivandrum	0·0	0·0	0·0
	Cochin	0·1	−0·6	0·1
	Calicut	0·1	−0·3	0·1
	Pattambi*	0·0	−0·2	0·0
	Taliparamba*			
	Kasargode*	0·0	−0·2	0·0
	Nileshwar*	0·0	−0·2	0·0
	Mangalore	0·0	−0·06	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·27	0·0
	Bangalore	0·0	−0·26	0·0
	Mysore	0·0	−0·13	0·0
	Mercara	0·0	−0·15	0·0
Hills	Kodaikanal	0·0	−2·88	0·0
	Coonoor			
	Ootacamund*	0·0	−0·6	0·0
	Nanjanad*	0·0	−1·1	0·0

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather Report for January 1940. Isolated light showers have occurred in South East Madras. Pamban reported 0·9″ on the 29th. Skies were lightly to moderately clouded in South East Madras and in parts of North Madras Coast and clear or lightly clouded elsewhere. Humidity was generally in excess in South Hyderabad and Mysore and in defect in South Madras and North Deccan, Maximum temperatures were below normal in the Madras Deccan and North Madras Coast. The minimum was above normal in the Bombay Deccan.

The rainfall was generally dry over the Presidency.

Weather Review for the Agricultural College and Research Institute, Observatory

Report No. 1/40.

Absolute maximum in shade	...	87·0°F.
Absolute minimum in shade	...	53·0°F.
Mean Maximum in shade	...	83·3°F.
[illegible] from normal	...	−2 6°F.

Mean minimum in shade	...	62·8°F.
Departure from normal	...	-1·4°F.
Total rainfall	...	Nil.
Departure from normal	...	-0·7″
Heaviest fall in 24 hours	...	Nil.
Total number of rainy days	...	Nil.
Mean daily wind velocity	...	1·6 m. p. h.
Departure from normal	...	-1·4
Mean humidity at 8 hours	...	73·4%
Departure from normal	...	2·8

Summary. Dry fine weather prevailed during the month. Rainfall during the month was nil. It is 0·7 inches below normal, Both the day and night temperatures were below normal. Skies were moderately to heavily clouded and the relative humidity was below normal. P. V. R. & F. L. D

Departmental Notifications.

Subordinate Services.

1. Appointments.

Sri R. Balasubramania Ayyar, Upper Subordinate IV Grade and Assistant in Cotton Section, Agricultural Station, Guntur, is appointed to a post in category 8 (Cotton section), Class I, Madras Agricultural service and to officiate as temporary Gazetted Assistant with effect from the 1st February 1940 or the date of taking charge.

Sri S. N. Chandrasekhara Ayyar, Assistant in Botany section, Coimbatore is appointed temporarily to officiate as Lecturer in Botany, Agricultural College, Coimbatore in Category 8, Class I, Madras Agricultural Service from the date of taking charge till further orders Vice Sri P. S. Jivanna Rao, on leave.

2 Promotion.

Sri S. Kuppuswami Ayyangar, Permanent Upper Subordinate Agricultural Section IV grade (old) on Rs. 120—10—170 is promoted to III grade (old) on Rs. 200 provisionally with effect from 15th August 1939.

3. Transfers.

Name of officers	From	To
Janab P. P. Syed Muhammad,	A. D. Omalur,	A. D., Tirupur.
Sri K. Hanumantha Rao,	A. D., Hospet,	Special duty at the sugar factory, Hospet.
,, Purushottam,	A. D., Anantapur,	A. D., Hospet.
,, P. Nagadhara Naidu,	A. A D., Madakasira,	Secretary, Cotton Market Committee, Nandyal.
,, U. S. Aiyaswami Ayyar,	A. D. (on leave),	A. D., Tiruvarur.
,, K. Srinivasa Acharya,	A. D., Tiruvarur,	A. D., Kalladakurichi.
,, E. R. Gopala Menon,	Entomology Asst., Tirupattur,	Entomology Assistant, Coimbatore to undergo a course of training in the Mycology Section, Coimbatore.

4. Leave.

Name of officers.	Period of leave.
Sri N. G. Narayana, Asst. in Cotton, Adoni.	Earned leave with pay for 1 month and 26 days from 24-1-40
„ K. Saptharishi, A. R. S., Aduthurai.	Extension of l. a. p. for 1 month from 3-2-40.
„ C. S. Seshagiri Iyer, A. D., Perambalur.	Extension of l. a. p. on m. c. for 2 months from 20-1-40.
„ L. Sankarakumara Pillai, A. D., Rasipuram.	Extension of l. a. p. on m. c. for 3 months from 4-2-40.
„ S. M. Kalyanaraman, Assistant in Cotton, Coimbatore.	L. a. p on m, c. for 1 month from 5-2-40.
Mr. James Colaco, F. M., A. R. S., Nanjanad.	L. a. p. for 1 month from 21-2-40,
Sri Kunhi Kannan Nambiar, Asst. in Paddy, Pattambi.	L. a. p. for 40 days from 10-2-40.
„ T. K. Mukundan. F. M., Central Farm, Coimbatore.	L. a. p. for 1 month from 21-2-40.
„ K. Rajababaniah. F. M., A. R. S., Guntur.	Extension of l. a. p. for 57 days from 2-2-40.

NOTICE

Such of the Members who have not yet remitted their subscription to the Madras Agricultural Journal for the year 1940 (January 40—Dec. 40) are hereby requested to kindly do so. An early remittance is solicited failing which the next issue will be sent by V. P. P.

Secretary,
M. A. S. U,

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVIII.] MARCH 1940 [No. 3.

EDITORIAL

The War and Fertilizers in India. In the January number of the 'Indian Farming', Mr. David Hendry discusses the effect of War on the use of fertilizers in India. The problem was not present during the last war, owing to the very limited use of artificial fertilizers by the Indian cultivator. But in recent years, on account of the lowering of prices of the inorganic manures rendered possible by the improvements effected in the manufacturing processes, the use of artificial manures, especially nitrogenous manures has increased to an enormous extent and more than 100,000 tons of sulphate of ammonia are consumed per annum. Of this quantity, only 19,000 tons are produced in this country, and the restriction placed in the export of sulphate of ammonia from the United Kingdom as a consequence of war, has therefore created a problem to the Indian cultivator, especially in Madras which is a 'fertilizer minded' province. The problem has to be solved either (1) by restriction in the use of the fertilizers to the quantity available in India, or (2) by increasing the out-put in this country. It is possible to some extent to restrict the use of artificials and supplement the nitrogen requirements by the application of oil cakes and fuller utilisation of farm yard manure, compost and green manure, in the case of crops like paddy, where the margin of profit to the cultivator is very narrow, but in the case of valuable money crops, like tea, sugarcane and potatoes, however, there is no doubt that crop production will be adversely affected if sufficient quantities of inorganic nitrogenous and phosphatic manures are not available at a reasonable cost. It is therefore necessary, that efforts should be made to increase our output to meet our demands, and we are glad to learn in this connection that the manufacture of sulphate of ammonia on a large scale has been taken up in Mysore and Mettur. The utilisation of the crude mineral phosphate available in certain parts of South India for the manufacture of super-phosphates, will, also we hope, receive the attention, it deserves from those interested in the development of the manure industry in this province.

Hostel Tatler. We have great pleasure in presenting to our readers, along with this number the students' supplement of the Madras Agricultural Journal. The students of the college have been for some years conducting a manuscript journal of their own, under the title 'The Hostel Tatler', and it was felt that the contributions in that Journal may provide, amusement to others besides the present students of the college-especially the old boys of the college in the mofussil. The publication of the supplement, has been rendered possible by the generous offer of the students to defray part of the cost of production and we have no doubt that their enthusiasm will be rewarded by the grateful appreciation of the readers of the Madras Agricultural Journal. The supplement reveals the existence of a considerable amount of artistic skill, orignality and literary talent in our students, which deserve encouragement.

Our heartiest good wishes to the success of the 'Hostel Tatler.'

Orchard Efficiency Analysis in Mangoes (*Mangifera Indica* Linn.) and Oranges (*C. Sinensis* Osbeck)

BY K. C. NAIK, B. Ag. (Bom.), M. Sc. (Bristol),

Superintendent, Fruit Research Station, Kodur.

Introduction. The Presidency of Madras is reputed to be one of the leading producing centres of mangoes and sweet oranges. According to the latest figures (2) the province claims an area of 244,945 acres under mangoes with a marketable production of 20,000,000 railway maunds of fresh fruits, of which 400,000 railway maunds are exported annually to other parts of India. Although the sweet oranges comprising mainly of two commercial varieties viz., the Sathgudi and Batavian account to-gether at present for a production of 195,000 railway maunds, about 65% of the orchards under these two varieties are yet young and have not reached the bearing stage.

An outstanding feature of the mango production in this part of India is that, it is not the result of a few standard commercial varieties but of a vast number of distinct horticultural entities, many of which constitute nothing more than mere local curiosities. In the Ceded districts, although a very large number of varieties are under cultivation, those that are extensively grown, are Neelum, Bangalora, Mulgoa, Andrews, Baneshan, Khader and Peter. It is gradually being recognised that efficiency of production and marketing requires that the orchards should be stocked with a limited number of economically profitable varieties instead of the prevailing multiplicity of varying forms and types of good or indifferent value. Information on the commercial value of each of the various varieties is, therefore, being increasingly sought for, especially for the raising of new plantations.

In the case of sweet orange plantations, however, seed propagation has been the rule in South India till very recently. It is in the very nature of seed propagation, that the plants raised become extremely variable, so much so that it is found impossible to obtain a standardised crop from any single plantation. The promiscuous crossing that takes place in nature between conjugally compatible varieties and species of citrus, have led to the origin of numerous and varied types and forms, so that the efficiency of orange production is found to be fast undergoing a process of quality deterioration. However, the polyembryonic nature of sweet orange (6) and the consequent origin of large number of apogamic seedlings identical to the seed parent has possibly served as a check in this down-ward march of the South Indian orange industry.

Hodgson (3) has pointed out that the factors governing successful production of fruits of any of the varieties 'depend primarily upon the environment, cultural practices and inherent character of the trees. In a crop like mango, which hardly receives any cultural attention in the Ceded districts after the trees attain the bearing stage, and which does not seem to afford much scope for improvement of cultural pratices at the present stage of low

orchard returns, the possible improvements that can be effected appear to lie primarily in the direction of stocking the orchards with inherently highly productive and choice fruiting trees of economically profitable varieties. Such a step will also be obviously necessary in the case of sweet orange plantations, especially in view of the very wide variation in orchard returns from plantations located under apparently identical conditions.

As a means of visualising the relationship between orchard productivity and inherent bearing capacity of the trees and varieties, separate investigations dealing with mangoes and sweet oranges were initiated at the Fruit Research Station, Kodur, during 1936 and 1937, respectively. The results presented in this paper relate to the data collected for these investigations during the period of four years in the case of mangoes and three years in the case of sweet oranges.

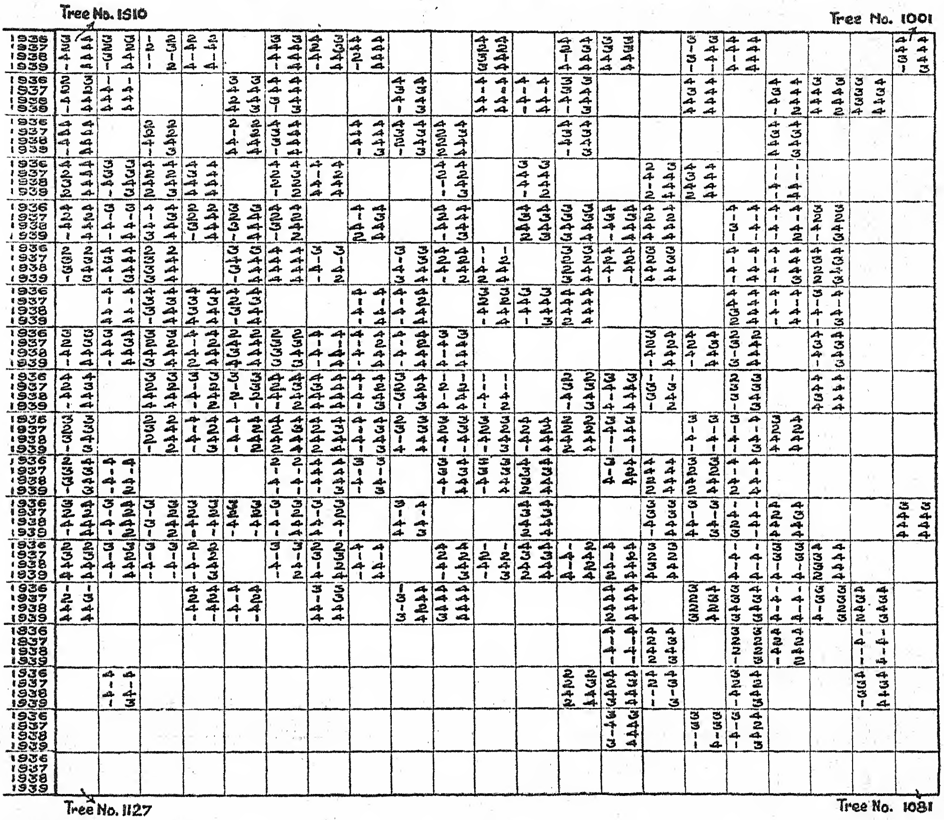
Materials and Methods. A private mango grove at Kodur covering an area of about 50 acres and containing 1632 bearing trees of 25 different varieties was selected for one of these investigations. For the study with sweet oranges, two separate sathgudi (syn. chinee orange) orchards, close to the Fruit Research Station, Kodur and located at a distance of about 440 yards from each other, and consisting of 212 and 102 seedling trees respectively of uniform age and in full bearing condition were selected. The former orchard has been designated as No. 1 and the latter as No. 2 in this paper.

The performance records of individual trees in these three plantations were estimated according to the lines suggested by Hodgson (3). Briefly, for the purpose of recording data and analysis of the results the system adopted consisted of the arbitrary fixing of four classes of trees according to relative production, taking the normal full crop for the year as the standard. The numerals 1, 2, 3, and 4 were used to designate heavy, medium, poor and no crop-production respectively. In the case of mangoes estimates of flower production in the case of each tree were also made and recorded similarly.

Since a number of trees in the mango plantation consisted of weak or diseased individuals, it was felt necessary to include for the purpose of analysis only such trees as were of apparently uniform vigour and growing as close together as possible in compact areas. In all, 434 Neelum trees in 5 separate plots, 630 Bangalora trees also in 5 different plots, 41 trees of Andrews variety in one plot and 38 Mulgoa trees in yet another plot were finally selected for the purpose of analysis. The specimen records from a Bangalora Block plot are given in Fig. I. Such a necessity for selective analysis was not felt in sweet orange plantations, as almost all the trees were very uniform in vigour and health.

In presenting the data in this paper, the performance of the first and the last class of trees have only been taken into account. This restriction is expected to reduce the error in estimation of performance due to personal factor to the narrowest limits possible.

Performance Record Chart of Bangalora Block-Y-C. R. Garden, Kodur 1936–39.



INDEX

Figure I.

1. Heavy flowering or fruiting. 2. Medium. 3. Poor. 4. Very poor no flowering or fruiting.

Note. 1. The left hand figures in each square indicates estimated flower records, while the figures on the right stand for estimated fruit yield records for the same tree in that square for the year.

The sathgudi orange is, however, known to bear two main crops regularly in a year in this tract. This feature has rendered necessary to estimate the performance of trees selected for these studies at two different periods of the year, and analyse these data separately for each crop.

Data and Discussion of Results.

1. **Mango performance records.** In statement No. 1 are given the percentages of poor and heavy flowering trees in each of the four varieties under study during 1936–39.

It is seen from the above figures that on the basis of flowering, the percentage of profitable trees has not exceeded in any year 11·7 in Neelum, 49·0 in Bangalora, 14·6 in Andrews and 42·1 in Mulgoa. On the other hand, the percentage of poor flowering trees has been as high as 74·8 in Neelum, 80·2 in Bangalora, 90·3 in Andrews and 93·7 in Mulgoa.

Statement 1. Showing the percentages of poor and heavy flowering trees of 4 varieties of graft mangoes at Kodur. 1936—1939.

Total number of tress: Neelum=434, Bangalora=630, Andrews=41, Mulgoa=38.

Particulars.	1936				1937				1938				1939			
	Neelam.	Bangalora.	Andrews.	Mulgoa.	Neelum.	Bangalora	Andrews.	Mulgoa.	Neelum.	Bangalora.	Andrews.	Mulgoa.	Neelum.	Bangalora.	Andrews.	Mulgoa.
Percentage of poor-bearing trees	60·6	74·3	90·2	79·0	58.3	43·2	78·8	52·7	70·6	80·2	90·3	93·7	74·8	35·0	66·4	39·5
Percentage of heavy-bearing trees	9·9	8·6	4·9	2·6	15·2	27·8	14·6	10·5	11·7	12·5	2.4	nil	6·4	49·0	9·7	42·1

Statement 2. Showing percentages of low, and heavy fruting trees of Neelum, Bangalora, Andrews and Mulgoa trees during 1936--39.

Total number of trees: Neelum=434, Bangalora=630, Andrews=41, Mulgoa=38.

Particulars.	1936				1937				1938				1939			
	Neelum.	Bangalora.	Andrews.	Mulgoa.	Neelum.	Bangalora.	Andrews.	Mulgoa.	Neelum	Bangalora.	Andrews.	Mulgoa.	Neelum.	Bangalora.	Andrews.	Mulgoa.
Percentage of poor-bearing trees	63·8	75·7	90·31	87·0	76·7	62·0	90·8	100·0	84·0	92·4	9·5	100·0	32·00	78·0	100·0	100·0
Percentage of heavy-bearing trees	9.0	7·9	2·4	2·6	3·1	9·0	nil	nil	7·1	5·0	2·4	nil	3·2	2·0	nil	nil

When the data relating to the estimated yield of fruits are similarly analysed, the low percentage of heavy bearing trees in the plantation is brought out more prominently, as is evident from statement No. 2.

The above figures show that the maximum percentage of heavy-yielding trees during the four-year period has been only 9·0 in Neelum and Bangalora, 2·4 in Andrews and 2·6 in Mulgoa, whereas the maximum percentage of poor-yielding trees has been 84·0 in Neelum, 92·4 in Bangalora and 100. 0 in Andrews and Mulgoa. An amazingly high presentage of unprofitable trees seems, therefore, a common feature in these four varieties of commercial importance in this tract.

The above data does not, however, represent an accurate picture of the relative economic importance of any of the four varieties, nor does it indicate the manner in which the varieties react to the popularly believed phenomenon of biennial or periodic bearing in mangoes. For this purpose the data have been analysed separately with a view to trace the performance of each individual tree of all the four varieties during the four-year period. This has furnished an idea of the proportion of trees in each variety that bear an uniform crop of flowers or fruits in two, three or four years during the four-year period. The summarised data are presented in Statement Nos. 3 and 4.

Statement No. 3. Showing the percentages of consistently heavy and poor flowering trees in a two-year, three-year and four-year periods.

Total number of trees ;— Neelum = 434 Bangalora = 630; Andrews = 41 Mulgoa = 38

Period	Consistently heavy-flowering				Consistently poor-flowering			
	Neelum	Bangalora	Andrews	Mulgoa	Neelum	Bangalora	Andrews	Mulgoa
Any 2-year period	6 9	25·4	4·9	5·3	89·2	65·9	95·1	89·5
Any 3-year period	0·2	2·1	2·4	nil	53·9	48·2	85·4	60·5
Any 4-year period	nil	0·1	nil	nil	19·6	13·9	41·4	13·2

Statement No. 4. Showing the percentages of consistently heavy and poor fruiting trees in two-year, three-year and four-year periods.

Total number of trees : Neelum=434. Bangalora=630. Andrews=41. Mulgoa = 38.

Period.	Consistently heavy-fruiting.				Consistently poor-fruiting.			
	Neelum.	Bangalora.	Andrews.	Mulgoa.	Neelum.	Bangalora.	Andrews.	Mulgoa.
Any 2-year period.	3·9	3·0	2·4	nil	94·5	98·7	100·0	100·0
Any 3-year period.	0·5	nil	nil	nil	74·2	80·0	95·1	100·0
Any 4-year period.	nil	nil	nil	nil	35·5	39·5	83·0	84·2

The following inferences are warranted from the above figures:—

(i) There is not a single tree in any of the four varieties that has produced consistently heavy or medium crop of flowers consecutively in the four-year's period under study, with the solitary exception of a Bangalora tree that has consistently borne heavy crop of flowers throughout the four year period.

(ii) On the other hand, the percentage of consistently poor-flowering or fruiting trees during the four-year period has been as high as 41·4 and 83·0 respectively in Andrews, 13·2 and 84·2 respectively in Mulgoa, 13·9 and 39·5 in Bangalora and 19·6 and 35·5 in Neelum. The existence of such a high percentage of consistently non-productive trees is a serious draw-back in the orchard under study.

(iii) The inferences drawn above for the four-year period apply almost in a similar degree to the three-year period also except that in the case of fruiting in Mulgoa and Andrews, the percentages of trees that bore poor crop of fruits consistently during three out of four years have been as high as 100·0 and 95·1 respectively. This surprising fact points out the utter futility of raising commercial orchards of these two varieties in this tract.

(iv) The percentage of consistently heavy-flowering trees in any two out of the four years has been the largest in Bangalora, but this advantage has not been maintained till the fruit ripening period. In fact, the percentage of consistently heavy-fruiting trees in any two years out of the four-year period has been only 3·9 in Neelum, 3·0 in Bangalora 2·4 in Andrews and nil in Mulgoa, while the percentage of consistently poor-fruiting trees in any two years has been as high as 94·5 in Neelum 98·7 in Bangalora and 100·0 in Mulgoa and Andrews.

The above facts clearly indicate that, one of the most important lines of improvement that requires to be effected in the mango industry in this tract is to increase the proportion of consistently productive individuals. Whether this can be brought about by propagation of plants from selected parents of inherently heavy-yielding capacities or by hybridization are questions that merit serious consideration in preference to the improvements that can possibly be effected through orchard cultural practices

That Mulgoa and Andrews are not commercially profitable varieties in this tract has been clearly brought out from these studies. In a separate series of investigations not reported herein, it has been found that Neelum and Bangalora possess the longest marketing season and Mulgoa has a very low percentage of perfect flowers in the panicle, which results in its shy-bearing habit. A study of the prices realised by some of the important varieties during a period of six years (1931—1936) has also revealed that, as against an average of Rs. 6 per basket received for Mulgoa and Andrews during the height of the season, Neelum commands a price of as much as Rs. 10 per basket towards the close of the season, when fruits of the above varieties are scarce, even though during the mid-season the price may range from Rs. 1—8—0 to Rs. 3 per basket. The relatively higher and regular bearing tendency of Neelum, its longer marketing season, its ability to command fancy prices at the fag end of the season and also its frequent production of a fair-sized off-season crop of high marketing value marks out

this variety as the most suitable for commercial planting in this tract, even though its quality is inferior to that of Mulgoa and Andrews. Between Bangalora and Neelum, the latter commends itself more to the growers, because of its better fruit quality and its frequent habit of production of off-season crops.

With a view to gather some information about the possible effect of a heavy or poor crop in one season on the yield in the following seasons, the estimated yield records were further analysed separately for each variety. These revealed that, in the case of Neelum, for every 100 trees that bore heavy crops of fruits in 1936, only eight trees bore heavy yields in 1937, ten trees in 1938 and 13 trees in 1939. This shows that the possible exhaustion effect caused during 1936, had not been made up during the following three years. It further shows that, the popular conception of an off-year following alternately an on-year is not substantiated. Similarly, when the performance of the poor-bearing Neelum trees are traced, it is found that, of the 100 such trees in 1936, 78 in 1937, 87 in 1938 and 81 in 1939 continued to bear poor crops. In the same manner, out of 100 trees that bore heavy crops in 1936 in Bangalora, only ten in 1937 and 1938 and six in 1939 bore heavy crops, while of the 100 trees that bore poor crops in this variety in 1936, 62 in 1937, 94 in 1938 and 88 in 1939 continued to bear poor yields. All these facts seem to conclusively support the previously recorded inference that, in a given tree an on-year does not necessarily follow an off-year. In other words, the bearing in mangoes seems to be governed not entirely by the performance of the trees in the previous year nor by the supposedly existing phenomenon of biennial bearing, but mainly by the inherent character of the individual tree, including possibly parts thereof, and also by other environmental factors including the incidence of pests and diseases and cultural practices.

Orange performance records. It has been stated previously that sathgudi orange bears two main crops in a year in Ceded districts, but it often happens that irregular blooming periods also get intercalated between these two main periods, resulting in the availability of fruits practically throughout the year. The blooming period for the winter crop, which forms the largest bulk of the produce varies slightly from season to season, having occurred during the last three weeks of February in 1937 and 1938 and last week of January in 1939. The harvest of this chief crop of the year was done during December-January in 1936–37, November-March in 1937–38 and November-January in 1938–39. For the second crop, flowering has occurred from last week of September to the beginning of December, and harvest was done from June to August during the period under study. Prevailing prices in the market offer an inducement to the growers to pick immature fruits, while in some years premature harvest is necessitated by the attack of fruit moth, *Ophideres.* These factors are also expected to affect the tree yield not only during the season but also in the immediately succeeding one.

Unlike in the case of studies in mango orchards, it has been possible to take an actual count of the fruits borne on each individual tree in the two sathgudi plantations. Besides furnishing a more accurate standard for the grouping of the trees into heavy and low bearers, the above method has also shown an indication of the relation between the tree yields in the two bearing seasons. In the following statements are presented the information gathered from these two orchards during the first two years viz., 1936-37 and 1937-38 as also a summary of the compiled information collected during the entire 3-year period.

Statement No. 5. Summary of information gathered from Orange Orchard analysis.

Particulars	Garden No. 1		Garden No. 2	
	1936—37	1937—38	1936—37	1937—38
1. Percentage of non-bearing trees and trees bearing less than 50 fruits each.	23·6	7·2	52·9	25·2
2. Average number of fruits per tree for the year.	135·8	557·43	66·10	300·7
3. Average number of fruits per bearing tree in 1st season.	156·3	529·0	90·9	297·0
4. Average number of fruits per bearing tree in 2nd season.	28·5	20·8	35·7	6·5
5. Average number of fruits per bearing tree for the whole year.	154·8	565·63	84·4	329·8
6. Maximum yield per tree in 1st season.	935	1400	320	1200
7. Maximum yield per tree in 2nd season.	150	95	200	40

Statement No. 6. Showing the orchard efficiency analysis during 1936—39.

Season of bearing	Garden No. 1		Garden No. 2	
	Heavy bearers %	Low or No bearers %	Heavy bearers %	Low or No bearers %
1st season	17·48	12·62	19·80	30·21
2nd season	16·50	59·71	37·50	39·50

The above data make it clear that, from the point of view of gross crop yield, garden No. 1 has proved to be a distinctly more valuable asset than garden No. 2. This difference is primarily due to the existence of a larger percentage of non-bearing or low-producing trees in the first season and also due to a relatively lower tree yield in that season in the latter garden than in the former. Although garden No. 2 has shown during the 3 year period to possess a higher proportion of high yielding individuals, especially

of the class that bears the second season crop, this advantage has been offset by the other unfavourable features mentioned above.

While the size of crop per tree or garden or season is clearly subject to considerable variation the ratio between the yields of the two seasons continues to be very wide, so that the second crop forms but a very small part of the gross yield in the year. This, however, does not detract the economic value of the second crop, which usually sells at a rate thrice or four times of that realised for the fruits of the first crop.

It seems clear from the orchard effeciency data for the three-year period that, unlike in mangoes the consistently poor or low-yielding trees in sathgudi orange plantation form a small proportion, not exceeding 30·21% in the first season and 59·71% in the second season. Garden No. 1, which is reputed to be one of the most profitable in this tract possesses only 12·62% of the trees that are consistently unprofitable on the basis of the yield records of the first season. The analysed figures of cropping furnished for three typical sweet orange plantations by Hodgson (3) have shown that the percentage of unprofitable trees range from 13 to 32, while in the average orchard the percentage may be over 50. Judged by this standard, it seems that the best seedling orange groves of the Ceded districts can favourably compare with the best budded orange plantations in California. On the other hand, the percentage of profitable or heavy-yielding trees in California has been found by Hodgson to vary from 26 to 68, while in Philippines, the percentage of such trees has been found to range between 2·94 to 51·28 in the four Batangas mandarin groves (4). Notwithstanding the possible differences in the grouping of trees according to yields as adopted in California and Philippines, an inference that seems valid is that, there is scope in this tract for increasing the orchard yields by increasing the number of inherently high yielding trees.

Webber (5) and Batchelor and his co-workers (1) have shown that the variations in orange tree yield is likely to be considerably influenced by the variations inherent in the buds due to heritage. Even if it be true that, orchard environment may be more potent than genetic factors in influencing productivity (4), the value of selecting only such trees as have been raised from high-yielding individuals seems well established for ensuring maximum productivity. Since seed propagation in citrus, despite its polyembryonic character cannot be depended upon to produce every progeny true to the parents, such selection of budlings from high-yielding parents is only possible through vegetative propagation, especially through budding, which is the most economic of the latter methods.

Vegetative propagation is known to be specially valuable in mangoes, because of the mono-embryonic character of most of the Indian varieties. The continued and extensive recourse to this method through ages has however, not increased the proportion of inherently productive individual trees, possibly because of the lack of any selective process in the parent

material. Because of the alleged phenomenon of 'periodicity of bearing' in mangoes, it may also be impracticable to secure as high a proportion of consistently productive parent trees in a mango grove as in citrus.

Nevertheless, from the economic view-point of the grower, the most important measure that requires to be devised appears to be that, which has as its objective a definite increase in the orchard effeciency. Rigorous selection of parent material, control of the so-called phenomenon of 'periodicity of bearing', or employing suitable rootstocks are some of the possible methods that can be adopted towards the realisation of these objectives. On the other hand, in the case of sathgudi orange, while the value of selection of parents cannot be denied, the greater importance of cultural propagation and rootstock investigations appears to be indicated to enhance the orchard receipts through better fruit quality, disease resistance and an increased productivity in the medium or low-cropping individuals.

It also appears that the simple method of orchard analysis adopted in these investigations will be most useful in evaluating the intrinsic orchard value. It would thus furnish a more efficient means to the purchaser of a bearing orchard of determining the orchard value than any of the prevailing methods.

Summary. 1. An amazingly high percentage of unprofitable trees has been found to form a common feature in Neelum, Bangalora, Andrews and Mulgoa varieties of mango in the Ceded districts.

2. Out of 1143 trees of four varieties under study, there is only a single tree of Bangalora variety, which has consistently borne heavy crop of flowers during the four-year period. Not a single tree in any of the four varieties has produced heavy or medium crop of fruits consistently during this period.

3. Since over 95 % of the trees of Mulgoa and Andrew have borne consistently poor or no crop during the 3 out of our years under study, and since the percentage of heavy fruiting trees in any one year has not exceeded 2·6, it appears futile to include these varieties in commercial plantations.

4. Neelum has proved to be the most economically profitable variety in this region.

5. The popular conception that an off-year is invariably followed by an on-year or *vice versa* is not substantiated.

6. The orange garden No. 1 has proved to be a distinctly more valuable set than No. 2.

7. While the possibility of increasing the number of heavy-yielding trees by vegetative propagation and selection of parent material is indicated, increasing of yields of medium and low croppers are found to be of greater importance in oranges, unlike in mango orchards.

8. The simple method of orchard analysis adopted in these investigations is likely to offer an efficient means to the purchaser of a bearing plantation of determining the intrinsic value of the trees grown therein.

Acknowledgment. Thanks are due to Messrs. P. Parthasarathy, C. Bhujanga Rao, G. Venkatakrishnan and S. Mahadeva Iyer for their assistance in collecting the data at different stages during the period of their training at the Fruit Research Station, and to Messrs. P. Changal Reddy, B. Jayaramaiah and B. Seetharamaiah for affording facilities to collect data in their respective orchards.

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A Reply to Critics

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The activities of the Agricultural Department, are often subject to criticism, in the press, on the platform, and also in the legislative chambers. The object of this note is to meet those criticisms by explaining the handicaps which the Departmental staff have to face in the course of execution of their duties. Before proceeding to examine the most common criticisms levelled against the Department, it seems desirable to place before the reader an idea of the number of officers employed and their jurisdiction, to enable him to realise the nature of such handicaps and judge for himself whether the criticisms are justified or not.

The Department, as at present constituted, has two main functions to perform viz., *Research* and *Propaganda*. The activities of the research side are confined to the Agricultural Research Institute located at Coimbatore and also at different farms situated all over the presidency. For the purpose of propaganda, the presidency is divided into four circles and in each circle a technically trained officer styled as Agricultural Demonstrator is placed in charge of one taluk.

It may be safely assumed, that in this Presidency, each taluk on an average comprises about 150 villages and as already pointed out, all these villages will be in charge of one Demonstrator who will be assisted by two skilled coolies. It is impossible for a single individual to cover this wide area, extending on a modest estimate over 300 square miles and tackle all the ryots who will easily number a few thousands. The criticisms one often hears or reads of, are (a) the Agricultural Demonstrator is not to be seen, (b) the existence of the Agricultural Department is not known to the ryots, (c) the Agricultural Department has done next to nothing, (d) the recommendations of the Agricultural Department are too costly for an average ryot to adopt and (e) the money spent on the Agricultural Department is not commensurate with the benefits derived by the ryots.

(a) *The Agricultural Demonstrator is not to be seen.* Prior to 1931, the method of propaganda in vogue was, the Demonstrator was allowed to tackle as many ryots as possible all over the taluk. Tha result was the jurisdiction being so wide, the ryots could not be frequently met and consequently there was no continuity in the work started in any one place. In order to rectify these defects and with a view to concentrate the work which is essential for the introduction of improvements, the policy was changed.

In accordance with the present policy, each Demonstrator is expected to select eight villages, on the basis of one village for each *firka* in the taluk, and concentrate work not only in those villages styled as "central villages" but also in the surrounding villages situated within a radius of

about five miles. The number of villages now tackled will be about 50 for each taluk. The work is concentrated in those eight groups of villages for a period of three to five years and then a fresh batch of villages are tackled. In addition to the work carried on in those fifty villages, if any calls are received from other villages in the taluk, the Demonstrator is expected to attend to them.

On the basis of the present policy it will take about 15 to 25 years to tackle all the villages in each taluk. It has often been the experience of workers in rural reconstruction schemes that when once the "guiding hand" is removed, things revert to the old order and therefore it is essential that there is continuity in work. The critics will do well to recognise these facts and strive to increase the strength of staff for each taluk, so that not only all the villages can be tackled at the same time, but also there can be continuity in the work which is once started.

(b) *The existence of the Agricultural Department is not known to the ryots.* People who generally make this criticism have the Revenue Department in the background as a standard for comparison. It is a fallacy to compare the Agricultural Department with the Revenue Department which has a staff in each and every village in the taluk. It is not possible for a single officer to make his presence felt all over the taluk as the table below will indicate :—

	Staff of	
	Revenue Department.	Agricultural Department.
Village.	Karnam and Munsiff.	Nil.
Firka.	Revenue Inspector.	Nil.
Taluk.	Tahsildar.	Demonstrator.
Division (Group of two to four taluks.)	Sub-Collector or Deputy Collector	Nil.
District.	Collector.	Nil except Vizagapatam. (There are 13 Assistant Directors for 25 Districts).

Sir John Russell, F. R. S., Director of the Rothamsted Experiment Station, England, who recently toured and examined the various agricultural research schemes in progress, in different parts of India financed by the Government of India, remarked in an article on "Science and the Indian Peasant", contributed to the *Journal of the Royal Society of Arts.*

"What India needs now, is not so much new scientific knowledge about general agriculture, but fuller use of existing knowledge and the working out of methods to reduce the present wide gap between the ordinary cultivator and the experimental farm".

This gap can be bridged only by increasing the staff employed on propaganda side. If this is accomplished, the critics will have earned the gratitude of thousands of ryots who are now outside the fold of the activities of the Department.

(c) *The Agricultural Department has done next to nothing.* One has to study the work done by the Department only on two major crops viz., Paddy and Sugarcane—the two important representatives of the 'subsistence' and 'money' crops, to realise the uncharitable nature of this criticism. The Department has nearly sixty strains of Paddy suitable for cultivation under different conditions. These strains are never distributed unless their yield is at least, ten per cent over that of the local variety which they are intended to replace. In addition, some of the strains fetch better price in the market than local variety due to purity of stuff, fineness of grain and other qualities. It is found impossible to arrive at, even to an approximate extent, the spread of Departmental strains in the Presidency. The demand for the seed is so great that the Departmental farms are not able to meet them and consequently the supply has to be arranged from ryots who grew them in the previous season.

In the case of sugarcane the achievement of the Department is much more spectacular. Almost the entire area in the Presidency is under varieties introduced by the Department from time to time. Many more such examples can be cited.

(d) *The recommendations of the Agricultural Department are too costly for an average ryot, to adopt.*

The economic side of any improvement advocated by the Department has always received the first consideration before introduction. The improvements advocated may be broadly classified under three groups viz., (i) Cultural—to reduce the labour bill, (ii) manurial—to increase the net profit (iii) varietal—to increase yield. There is a large demand for seeds of strains, evolved by the Department especially in the case of paddy, cotton and groundnut which the Department is finding difficult to meet.

The Loans issued by the Departmant for the purchase of implements has increased from Rs. 130 in 1931—32 to Rs. 18,188 in 1938—39. Several examples of other improvements advocated, which have been easily adopted by ryots can be cited to prove that they are not costly.

(e) *The money spent on the Agricultural Department is not commensurate with the benefits derived by the ryots.*

In this Presidency, the area under Paddy snd Sugarcane according to the season and crop Report for 1937—38 was 10,140,831 and 97,965 acres respectively. Assuming for argument's sake that the departmental paddy strains have spread only over 5 per cent of the total area (i. e.. 507041 acres) and the value of the increased yield obtained is only about Rs. 5 per acre, annual gain to ryots by growing the improved paddy strains alone will roughly be about Rs. 25,35,205.

Similarly in the case of sugarcane, a crop practically the entire area of which is under departmental varieties, the annual gain to ryots will roughly be about Rs. 48,98,250, assuming that the value of increased yield due to

cultivation of departmental varieties is about Rs. 50 per acre—a very low figure.

The annual budget grant of the Agricultural Department is Rs. 21,065,00 —much less than a modestly estimated profit from either paddy or sugarcane and that in a single item of improvement advocated in both the crops viz., growing of improved strains evolved, or introduced by the Department. Figures speak for themselves, hence no further comment is necessary.

5. It is sincerely hoped that critics of the Department will bear these facts in mind and endeavour to ' bridge the gap " as advised by Sir John Russell by enabling the Government to increase the staff on the propaganda side, which seems to be the only way to improve the lot of the peasant.

Molasses as Food.

Experiments concluded at the Massachusetts Institute of Technology show that old-fashioned molasses is about the best food known for treating nutritional anaemia, the kind of anaemia due to improper diet. *Science, Vol. 90, October 27, 1939.*

Whereas molasses has 6·1 parts of usable iron per 100,000 parts by weight, spinach has only 0·5, beef liver has 5·6 ; oatmeal 4·6 ; apricots, eggs and raisins following in that order. Usable iron was computed, not total content, for only that iron which the body can use to manufacure hemoglobin is valuable. Both chemical and biological tests on rats were used. —Science, Vol. 90, October 27, 1939.

The Late Rao Sahib T. V. Rajagopalachariar.

Rao Sahib T. V. Rajagopalachariar whose unexpected death in the early hours of the 8th instant we now mourn was born in the late seventies of the last century at Tirukkarungudi, an important Vaishnavite centre in Nanguneri taluq of the Tinnevely district. This village was always dear to his heart. It was an ancient South Indian village typical of the then existing village organization in many respects.

The late Mr. Acharya came of a very devout Sri Vaishnavite family and had his education in his own village in Palamcottah and at the S. P. G. College, Trichinopoly' With an inborn bent for agriculture, he joined the Madras College of Agriculture at Saidapet and took his Diploma in due course. As was the wont at the time he was drafted into the Revenue Department. He joined the Board of Revenue and when the expansion of the Agricultural Department gave a reorientation to the policy of the Government, he was transferred to that Department. Having served his apprenticeship in the Bombay Experimental farms for a year, he was put in charge of the Koilpatti Cotton Farm where investigations on 'Tinnies' and other allied problems were taken up. Later he was transferred to the charge of the Central Farm, Coimbatore. Subsequently he saw service in the Godavari and Kistna deltas and spent considerable time in the Ceded district, particularly at the Hagari Experimental Station.

During this period he had gained experience in the 'Hadi process' of Gur and sugar making, having been deputed by government to the United Provinces. With such varied knowledge of the conditions of the agricultural industry in Bombay, the United Provinces and Madras, he was considered eminently fit to be in charge of teaching agriculture at the Coimbatore Agricultural College which had very shortly to be affiliated to the University of Madras. He was gazetted Lecturer in Agriculture in 1920 and put in charge of teaching agriculture for B. Sc. (Ag.) students. In September 1929, he was promoted to be officiating Vice Principal in which capacity also he continued to be in charge of teaching until he retired in June 1932. In recognition of his valuable services to the cause of agriculture, Government conferred on him the title of 'Rao Sahib' in 1931.

During the period of his retirement (alas of less than eight years) he continued his active habits and was connected in various capacities with all the important organisations of the town, Theosophical, Co-operative, Humanitarian Societies like the S. P. C. A., Civic Bodies like the Rate Payers' Association, and Social Clubs. He was one of the first Directors in the now very successful City Milk Supply Union and he was always full of ambitious schemes for ameliorating the condition of his people. On the technical side he was associated with the Senate and Academic Council of the Madras University and, was, of course, a valued examiner in agriculture. By his nature and character he commanded the respect of his colleagues in all these organisations.

He was an ardent theosophist, a willing and zealous co-operator, a critic of music, a discriminating astrologer, a progressivist in social reforms, a cosmopolitan in his outlook on life, a rationalist in religion, a believer in progress, and a thorough going optimist all his life. He was affectionate to a fault, a loving father, and a good friend and guide. All through the day and particularly in the evenings his friends used to gather round him to enjoy his inspiring talks on all matters, religious, social and economic.

(T. S. V.)

College News & Notes.

Personal:—Sri. C. N. Babu, B.Sc., who was for sometime a research student in the oil seed section and was till recently an Assistant in the Imperial Sugarcane Breeding Station, Coimbatore, has been conferred the degree of M. Sc. by the University of Madras for his thesis on "Cytological studies on Cymbopogon".

We offer our hearty felicitations to Sri. C. N. Babu.

Foot and Mouth Disease. Consequent upon the recurrence of "Foot and mouth disease" in the vicinity of the Agricultural College Estate, the precautionnary and control measures, temporarily withheld by the Central Farm authorities, have been again revived. The Central Farm animals are yet free from this disease.

Visitors. Mr. G. B. Patel, Cotton Botanist, Sind was on a visit to the Agricultural College and Research Institute during the last week of February. He addressed the Association of Economic Biologists on "Breeding of the Cotton in Guzrat".

Season and Water Scarcity. Very dry and hot weather is being experienced at Coimbatore at present. The absence of rains for the last 5 months has seriously affected the supply of water in almost all the wells in the District and the Coimbatore Municipality have taken advance precautionary measures by regulating supply of water, to guard against serious shortage in summer.

Mofussil News and Notes.

Karkala:—Cattle Fair at Sitanadi in Karkala Taluk of South Kanara District. For the benefit of the cultivators of Karkala, Udipi and Coondapoor taluks in the South Kanara district of the Madras Province, a cattle fair is being conducted at Sitanadi by the Cattle Fair Committee of Hebri under the auspices of the South Kanara District Board. The first fair was held in the year 1937. This fair lasts for about ten days just a week after the cattle fair at Kulkunda near Subramannya in Puttur taluk about 90 miles away, which is held about the third week of November every year. The Sitanadi cattle fair is held in the village of Hebri almost at the foot of the Agumbe ghat and provides good camping ground for cattle as well as sufficient pasturage and drinking water. Cattle of all classes are brought down from the Mysore State for sale. The following is the number of cattle that assembled at Sitanadi in December 1939.

Particulars of cattle.	Number.	Average cost.
He-buffaloes.	426	Rs. 75 per pair.
She-buffaloes.	147	Rs. 70 each.
Bulls.	20	Rs. 40 each.
Working bullocks.	790	Rs. 200 per pair. (Best animals). Rs. 25 per pair. (Inferior animals).
Cows.	7	Rs. 24 each (best animals). Rs. 15 each (Inferior animals)
Young stock.	24	
Total.	1414	

As this fair was started only recently, it has not yet attracted many cattle breeders. To attract the cattle breeders from all parts and also to induce the local people to pay better attention to the rearing of their own animals, prizes in the shape of gold and silver medals are being awarded for different items and the number of prizes awarded this year comes to 25.

During the cattle fair week, an Agricultural Exhibition was held in the cattle fair grounds when all the improved methods of agriculture were demonstrated and lectures on agricultural topics were delivered with the aid of the magic lantern. Leaflets on various subjects were distributed and samples of improved seeds of paddy, sugarcane, ragi, etc., were on show. The ryots who gathered at the fair evinced great interest in the exhibition and in the propaganda work of the Agricultural Department. M. U. V.

Ootacamund Flower Show. Ootacamund rightly called the Queen of hill Stations has a salubrious climate resembling that of Southern Europe and all the varieties of flowers and fruit growing in that region come up well here. The persistent efforts of the early settlers and the perseverance of the Agricultural Officers have established varied crops from the largely cultivated "Great Scot'. Potato to fine types of Japanese plums and the grape-fruit. All varieties of flowers growing in temperate regions from the beautiful Asters to the fragrant verbena thrive luxuriantly in the tastefully laid out domestic or public gardens.

The annual flower show, an important event of the Ootacamund season comes off usually on the last Saturday in the bright month of May. The show is organised by the Nilgiri Agri-Horticultural Society, a body of enthusiastic residents whose prime hobby is gardening. This society, first established in 1847 as an association for growing vegetables for its subscribers, functioned for a few years only. In 1896 the Nilgiri Agri-Horticultural Society was established by the then Collector. The first Horticultural show was held in October 1869, Under the new society the first show was held in 1897 when Rs. 191 towards prizes were offered for flowers, vegetables and other garden produce. It had been a very successful exhibition. In recent years the prize money offered for the different classes of exhibits amounts to about Rs. 1200. Potted plants, cut flowers, collection of flowers in baskets and vases of cut flowers, boquets, fruits, vegetables, Dairy produce, Farm and field produce, and livestock are the different classes of exhibits at the show. The prizes offered are restricted to the produce of the Nilgiris District. Outside exhibits are also permitted for enhancing the value of the show.

Fine specimens of flowers of varied hues and selections of different kinds of fruit and vegetables at the show present the art of Nature and what the patient gardener has produced after persistent toil for the aesthetic citizen.

M. T.

Pattukottai. During the inspection of the Pattukottai sub-circle by the Dy-Director of Agriculture, III circle, lectures were delivered by him at Adirampatnam, Amarkari and Thuruvarankurichie to gatherings of ryots. An Agricultural Association was strated on 11—2—40 at Thuruvarankurichie when about 100 ryots were present. Sri. S. Rajaratnam Pillai, the president of the Annaikkadu addressed the gathering and Sri. A. Arulanandam Pillai, one of the leading Mirasdars of the place, also spoke to the ryots about the usefulness of the department. Sri G. J. Balaraj, the local Agricultural Demonstrator addressed the ryots about the usefulness of an agricultural association. The Dy. Director of Agriculture addressed the ryots about improved scientific agriculture—Demonstration plots, green manuring, use of iron ploughs etc., and stressed, that as the village contains more of small land-holders, the starting of an agricultural association would do immense good to them. An Agricultural Association was immediately started with a president, Secretary and a committee.

At Adirampatnam, to a gathering of ryots, the Dy. Director addressed on agricultural improvements, and advised them to pay more attention to Agriculture and its side industries.

Tiruppur Cattle Fair. Annually cattle fair and pony show are held at Tiruppur in June during the local car festival. The entire stock of cattle brought to the fair for sale being the famous Kangayam breed, it attracts a large congregation of ryots from all over the district and the neighbouring districts. The show is specially important as the best cattle in the districts are brought for exhibition and sale.

The District Agricultural Association, Coimbatore, arranges a combined agricultural and industrial exhibition during this cattle fair and pony show in alternate years. The exibitions are staged by the Departments concerned and private ryots and the district agricultural association awards prizes for the best exhibits—agricultural products, cattle, pony etc. On account of this, the shows and exhibitions during such years are very important and attractive.

Tiruppur being close to the famous Kangayam breeding tract, almost all the animals brought to the exhibition are Kangayams which are poor milkers but noted as good work animals. The Pattagar of Palayakottai is a reputed breeder of Kangayams and almost all the prize animals entered for competition are those belonging to him or his direct dependants. In almost all the years, the gold medals for the champion cow and bull are won by him. A very large transaction by way of purchase and sale takes place on this occasion.

As for the agricultural exhibition, the Department usually puts the best show with the largest collection of exhibits both Departmental and otherwise. Private ryots also take part in the exhibition and put up attractive agricultural products. The Departmental exhibits usually consist of:—

(a) Improved agricultural implements and machinery, (b) Seeds, plants and products of different crops as paddy, cholam, ragi, cumbu, inferior millets, groundnut, castor, coconuts, cotton, sugarcane, fruits, vegetables, etc. (c) Malts and malt preparations, chemical charts, prepared cattle feeds, etc. (d) Diseased specimens of crops damaged by insects and fungii with control measures, (e) Sideline of farming-apiculture. (f) Manures and manure seeds—proper collection and preservation of cattle manure by different methods, pit and byre systems, loose box, etc., preparation of composts, green manure seeds etc. Besides, demonstrations also are conducted.

M. S.

Vridhachalam. An Agricultural exhibition was held at Vridhachalam from the 18th to 25th February during the Masi Magam Festival on which occasion about 8,000 people from all parts of the district congregated. Malt making with cholam and ragi grains was demonstrated. Lantern lectures with slides were delivered on 4 nights. Specimens of fodder grasses, live specimens of green manure crops, samples of oil seeds received from Agricultural Research Stations, Palur and Tindivanam were exhibited.

M. A.

Agricultural Jottings.

Grading of mangoes in Chittoor. Chittoor district is one of the biggest mango growing centres in this Presidency and has an area of 29,400 acres under mangoes. Varieties grown are Bangalora (Totapuri), Neelam, Peter, Khader and Malgoa in the order of acreage and these form the commercial varieties figuring largely in the export trade. Other varieties like Rumani, Kalapadi, Dilpasand etc. are also found here and there. The season commences in April and the early varieties like Peter, Khader and Malgoa come into the market till June. They are generally consumed in local markets like Madras, Trichinopoly and Madura

A few hundred maunds find their way to North Indian markets, but mainly due to competition much of the produce from Chittoor is unable to move to those markets in the early months. Later when this competition ceases, the Chittoor mangoes particularly the 'Bangalora' and later the 'Neelam' are exported from June to August in very large quantities. The total annual production of mangoes in the district is estimated at about two million railway maunds and the export trade to other provinces amounts to 114.000 Railway maunds per year. The chief exporting centres are Chittoor, Damalcheruvu, Kalahasti, Chandragiri and Puttur.

Daily one to three wagon loads are booked from these stations and during heavy seasons train loads move from some of these places. The average exports of mangoes from this district by rail for the past three years were as follows:—

Bombay 69,000 railway maunds, Central Provinces 29,500 railway maunds, Nizam's State 11,000 maunds and other provinces 5,000 maunds, besides about 50,000 railway maunds within the province.

Mangoes for export to Bombay and North India are packed in baskets. But to nearer markets like Madras, Trichinopoly, Madura, Salem and Hyderabad, no packing is done but they are despatched loose in wagons especially the variety Bangalora. This leads to a lot of damage in transit.

There is no regular system of grading the fruits. Big, medium and small are mixed generally. This leads to poorer prices being obtained. In order to demonstrate to the producers and merchants the benefit of selling the produce after proper grading an experimental grading station was opened during the last season at Chittoor. Preliminary work commenced in May, and exports commenced from the second fortnight of June.

Mangoes for export should first satisfy certain general conditions. The fruits must be firm; reasonably uniform in colour, and must have reached a certain stage of maturity. No mango should be entirely green and each should have the shape normal to the variety and should be free from malformation and defects due to disease or insects or mechanical injury.

The mangoes are then sorted according to their weight into three classes, Special, First Grade and Second Grade. Bigger fruits like 'Bangalora' and 'Malgoa' should have minimum weights of 40, 30 and 20 tolas per fruit for the above grades respectively; smaller fruits like 'Peter' and 'Neelam' should have 20, 12 and 8 tolas as minimum weights per fruit.

Each fruit of special grade is carefully wrapped in tissue paper, and then packed in baskets with straw layers. For other grades, individual fruits are not wrapped in tissue paper. Each grade is packed separately. The baskets are labelled with the special labels bearing the "AGMARK" design and are sealed. Each grade has a distinctive coloured AGMARK label. The label for Special is white, for first grade red, and for second grade blue.

Over 3500 baskets weighing about 1500 Railway maunds were despatched to Bombay and sales effected with the assistance of the Provincial Marketing Officer of that Province. Grading of fruits is appreciated by the Bombay merchants and a premium of four to eight annas per Railway maund was obtained for the special quality. The garden owners of Chittoor will therefore be well advised to take up grading of mangoes on a larger scale in the ensuing season. Those desirous of doing so can address the Provincial Marketing Officer, Post Box No. 414, Chepauk, Madras for further particulars and the necessary assistance.

Weather Review—FEBRUARY 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·1	−0·6	0·1
	Calingapatam	0·3	−0·2	0·3
	Vizagapatam	0·4	−0·5	0·4
	Anakapalli*	0·1	−1·2	0·1
	Samalkota*			
	Maruteru*	0·0	−1·0	0·0
	Cocanada	0·0	−0·3	0·0
	Masulipatam	0·0	−0·4	0·0
	Guntur*	0·0	−1·1	0·0
Ceded Dists.	Kurnool	0·1	−0·1	0·1
	Nandyal*	0·0	−0·3	0·0
	Hagari*	0·0	−0·3	0·0
	Siruguppa*	0·0	−0·3	0·0
	Bellary	0·0	−0·2	0·0
	Anantapur	0·0	−0·3	0·0
	Rentachintala	0·0		0·0
	Cuddapah	0·0	−0·1	0·0
	Anantharajupet*	0·0		0·0
Carnatic	Nellore	0·1		0·2
	Madras	0·0	−0·3	0·1
	Palur*	0·0	−0·7	0·0
	Tindivanam*	0·0	−0·9	0·6
	Cuddalore	0·0	−0·9	0·3
Central	Vellore	0·0	−0·3	0·0
	Salem	0·0	−0·3	0·0
	Coimbatore	0·0	−0·3	0·0
	Coimbatore A. C. & R. I.*	0·0	−0·5	0·0
	Trichinopoly	0·0	−0·6	0·0

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·1	−0·5	0·1
	Aduthurai*	0·0	−0·4	0·2
	Madura	0·0	−0·4	0·0
	Pamban	0·0	−0·7	2·2
	Koilpatti*			
	Palamkottah	0·0	−0·7	0·1
West Coast	Trivandrum	0·0		0·0
	Cochin	0·0	−0·8	0·1
	Calicut	0·0	−0·2	0·1
	Pattambi*	0·0		0·0
	Taliparamba*			
	Kasargode*	0·0	−0·2	0·0
	Nileshwar*	0·0	−0·2	0·0
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·1	0·0
	Bangalore	0·0	−0·2	0·0
	Mysore	0·0	−0·2	0·0
	Mercara	0·0	−0·2	0·0
Hills	Kodaikanal	0·0	−1·4	0·0
	Coonoor			
	Ootacamund*	0·0	−0·2	0·0
	Nanjanad*	0·0	−0·6	0·0

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The weather has been dry over the country but for the isolated light showers in the Konkan, North Madras Coast, South East Madras and the Madras Deccan. Skies were lightly to moderately clouded in South East Madras, North Madras Coast, Mysore and South Hyderabad, and clear or lightly clouded in the Konkan, and South Bombay Deccan. Humidity was in excess in the Konkan, Bombay Deccan and North Madras Deccan and in defect in South East Madras, Malabar and Mysore. Both maximum and minimum temperatures were above normal in the Konkan and below normal in the Madras Deccan, Mysore and North Madras coast.

Rainfall was practically nil and below normal throughout the presidency.

Weather Report for Agricultural College and Research Institute, Observatory, Report No. 2/40.

Absolute Maximum in shade	...	92·8°F.
Absolute Minimum in shade	...	58·0°F.
Mean maximum in shade	...	89·9°F.
Departure from normal	...	–0·6°F.
Mean Minimum in shade	...	63·8°F.
Departure from normal	...	–2·0°F.
Total rainfall for the month	...	Nil.
Departure from normal	...	–0·50″
Heaviest fall in 24 hours	...	Nil.
Number of rainy days	...	Nil.
Mean daily wind velocity	...	1·86 miles per hour.
Departure from normal	...	–088 miles per hour.
Mean Humidity at 8 hours	...	73·1%
Departure from normal	...	+1·2%

Summary. Weather was dry throughout the month. Skies were lightly to moderately clouded and the humidity was in slight excess. Rainfall was nil being 0 5″ below normal. Both the mean maximum and mean minimum temperatures were slightly below normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri. V. T. Subbayya Mudaliar, Upper Subordinate, Agricultural Section is appointed as officiating Assistant Director of Agriculture. Pattukottai in Category 6, Class I, Madras Agricultural service without prejudice to his leave.

Sri. A. Gopalan Nair, Farm Manager, Central Farm, Coimbatore is appointed to officiate as Assistant Director of Agriculture, Pattukottai during the absence of Sri. V. T. Subbayya Mudaliar on leave or until further orders.

Sri. D. Marudaraja Pillai, Assistant in Mycology, in Category I, Class I, Madras Agricultural Subordinate service is appointed to a post in category 5, Class I, Madras Agricultural service and to act as Government Mycologist. Coimbatore, Vice Sri. K. M. Thomas, granted leave.

Name of officers	From	To
Sri. V. T. Subbayya Mudaliar	Asst., D. A. Pattukottai.	Asst. D. A. Tinnevelly.

Leave.

Name of officers.	Period of leave
Sri. K. M. Thomas, Govt. Mycologist, Coimbatore.	L. A. P. For 3 months from date of relief.
Sri. R. Chockalingam Pillai, Asst. D. A., Tinnevelly.	Leave on half average pay for 6 months from 27-3-40.

Subordinate Services.

Appointments.

The services of Dr. R. Sankaran, Assistant in Cotton, are placed at the disposal of the Government of India for appointment as Cotton Botanist in Sind under the Indian Central Cotton Committee for a period of five years from 1st March 1940.

The following substantive appointments of Upper Subordinates in the Agricultural section are ordered with effect from 15th August 1939.

1. V. Chidambaram Pillai, Upper subordinate, Agricultural section provisionally substantive IV Grade to be substantive in the same grade.
2. P. P. Syed Muhammad Sahib, Upper subordinate, Agricultural section, provisionally substantive in new III grade to be substantive in the same grade.

Promotions.

The following provisionally substantive promotions are ordered with effect from 1st March 1940.

(1) Sri. S. Dharmalingam Mudaliar, Assistant in Paddy section, Pattambi in II grade old to I Grade (Old).

(2) Sri. T. S. Ramakrishna Ayyar, Assistant in Mycology section in III Grade (old) to II Grade (old).

Sri. M. Subrahmanyam Pillai, Upper subordinate Agricultural section, IV grade (Old) on Rs. 120-10-170 is promoted to III grade (old) on Rs. 200/- provisionally substantive-with effect from 15th August 1939.

Confirmations.

(1) Sri. K. Kuppamuthu to be permanent in the Agricultural section from 15—8—39.

(2) Sri. E. J. Verghese to be permanent Asssistant in the Mycology section from 15—8—39.

(3) Sri. N. G. Narayana to be Assistant in cotton from 15—8—39.

(4) Sri. C. K. Ramachandran to be permanent in the Agricultural section from 15—8—39.

(5) Sri, M. L. Balasundaram to be permanent in Agricultural section from 15—8-—39.

(6) Janab P. Abdul Samad Sahib to be permanent in the Agricultural section from 23—12—39.

(7) Mr. K. C. Thomas to continue to be provisionally substantive in the Agricultural section.

(8) Sri. B. S. Narasimhamurthi to be Assistant in Cotton provisionally substantive from 15—8—39.

(9) Sri. K. Saptharishi to be Assistant in Chemistry provisionally substantive from 15—8—39.

(10) Sri. P. Somayajulu to be provisionally substantive in the Agricultural section from 15—8—39.

(11) Sri. V. Venkatadri Reddi to be provisionally substantive in the Agricultural section from 23—12—39.

Transfers.

Name of officers	From	To
Sri. D. Visvanatha Reddi,	F. M.. Central Farm Coimbatore.	F. M., A. R. S., Anakapalli.
,, N. V. Narasinga Sastry,	F. M., A. R. S., Anakapalli	A. D. Kothepeta.
,, R. Ananthapadmanabha Pillai,	A. D., Mudukulathur	F. M., L. R. S., Hosur.
,, R. Subbiah Pillai	A. D., Satur	A. D.. Mudukulathur.

Leave.

Name of officers.	Period of leave.
Sri M. Satyanarayanamurthy, A. D., Yellamenchilli,	L. a. p. for 2½ months from the date of relief
„ P. Bhagirathi Padhi, A. D., Narasannapeta,	L. a. p. for 2 months from 1—3—40.
„ V. N. Subbanna Acharya, A. D., (on leave),	Extension of l. a. p. for 30 days from 27—2—40.
„ D. Panakala Rao, A. D., Ramachandrapuram,	L. a. p. for 2 months from 4—3—40.
„ K. Soopi Hajee Sahib, Lower Subordinate,	Extension of l. a. p. for 28 days from 4—3—40.
„ P. Seetharamaiah, Botany Asst., A. R. S., Anakapalli,	Extension of l. a. p. for 30 days from 14—3 -40.
„ N. Ranganatha Chari, A. D., Dhone,	L. a. p. for 30 days from 27—3—40.
„ B. Shiva Rao, A. D., Tuni,	Extension of l. a. p. for 2 months from 1—4—40.
„ P. Krishnaswami, Asst. Millets, D. F. S., Hagari,	L. a. p. for 1½ months from 27—3—40.


HOSTEL TATLER
AGRICULTURAL COLLEGE, COIMBATORE
P. PANDA

CONTENTS

Messages.

I welcome the proposal of your Union to bring out in the course of March 1940 a Students' Annual as a supplement to the Madras Agricultural Journal which has been doing distinct service to all those interested in Agriculture. The Annual, if it is properly conceived, is bound to serve as one more link between the Students of the Agricultural College and the officers of the Agricultural Department which would enable the latter to understand the students better and promote their interests. I wish the Annual every success and hope that it will gain strength year after year.

P. H. RAMA REDDI,
Director of Agriculture, Madras.

I have been requested to introduce a new-comer to Literary and Artistic circles—a publication, grave and gay, humorous yet thought-provoking, a production of the student mind and energy, which I hope will receive a favourable reception by readers privileged to peruse its pages. This journal arises as a result of a students' resolution passed at the Madras Agricultural Students' Union General Body Meeting in July last and for the present its publication will be as an annual. Although modelled on the lines of a well-known English publication, its contents will be entirely the work of the Students and it will represent their activities at work and play and this number clearly indicates the versatility of the students in the year of Grace 1940. It has my sincerest good wishes for its success. I hope it shall have many birthdays each more notable and encouraging than its predecessor. With these words I introduce this journal to its readers.

R. C. BROADFOOT,
Principal, Agricultural College.

I have great pleasure in responding to the request of the Secretary, Madras Agricultural Students' Union for a message of good wishes on the occasion of the publication of the Students' Annual as a supplement to the Madras Agricultural Journal. The decision of the Union to publish a Students' Annual has been a happy one as it has afforded an opportunity to the students to display their talents. Let me congratulate the students on their excellent production and wish the Annual every success.

M. C. CHERIAN,
Vice-President, M. A. S. Union.

My hearty greetings to the "Students' Annual", the happy consummation of the earnest endeavours of the students for the past two years.

It gives me added pleasure to send this message, having been connected with the Madras Agricultural Students' Union as Manager and Secretary during this period.

The "Tatler" bud of the Hostel has developed into the 'Annual' fruit of the Union. I am sure that this supplement of the students' activities will serve as a dessert to the 'scientific' menu purveyed in the columns of the Madras Agricultural Journal.

I wish the Students' Annual many happy returns.

P. A. VENKATESWARAN,
Hostel Warden.

I have very great pleasure in responding to your request to send a message of good wishes on the occasion of the Madras Agricultural Students' Union taking yet another step in making it more popular and widening its sphere of appeal, especially to the ex-Students of this College, by publishing a Students' Annual as a supplement to the Madras Agricultural Journal.

The Madras Agricultural Journal is primarily concerned with publishing scientific investigations, carried on mostly by the members of the Department, in simple and popular language so that the results of the scientific work may be clearly grasped and practised by the subscribers to the journal, some of whom may not be so well versed in science as to follow the original articles replete with scientific terms.

Another function which it has been successfully discharging is that of serving as a medium for publishing the activities of the students of the College on a page named " Students' Corner " and thereby serving as a link between the past and present students of the Agricultural College. The space devoted was not commensurate with the numerous and diverse activities, and the management has been considering for some time past ways and means of adequately conveying them to the readers in general and to the ex-students of the College in particular who, I understand, turn, on receipt of the Journal, to the " Students' Corner " first to acquaint themselves with the achievements of the present batch of students, to which they may have themselves contributed while in *Statu pupillari.*

It gives me very great pleasure and satisfaction to learn that the management of the Journal has solved the difficult problem by issuing a Students' Annual as a supplement to the Journal.

I send my hearty congratulations to those who guide the policy of the Journal on this occasion of making a departure, which will not only find favour with the readers but will widely be welcomed by them. To the students also, I convey my felicitations on their successful negotiations to acquire wider publicity to their activities and I earnestly hope that the Annual Supplement will be prepared with considerable care and pains, so that it will be in consonance with the high traditions of the Journal.

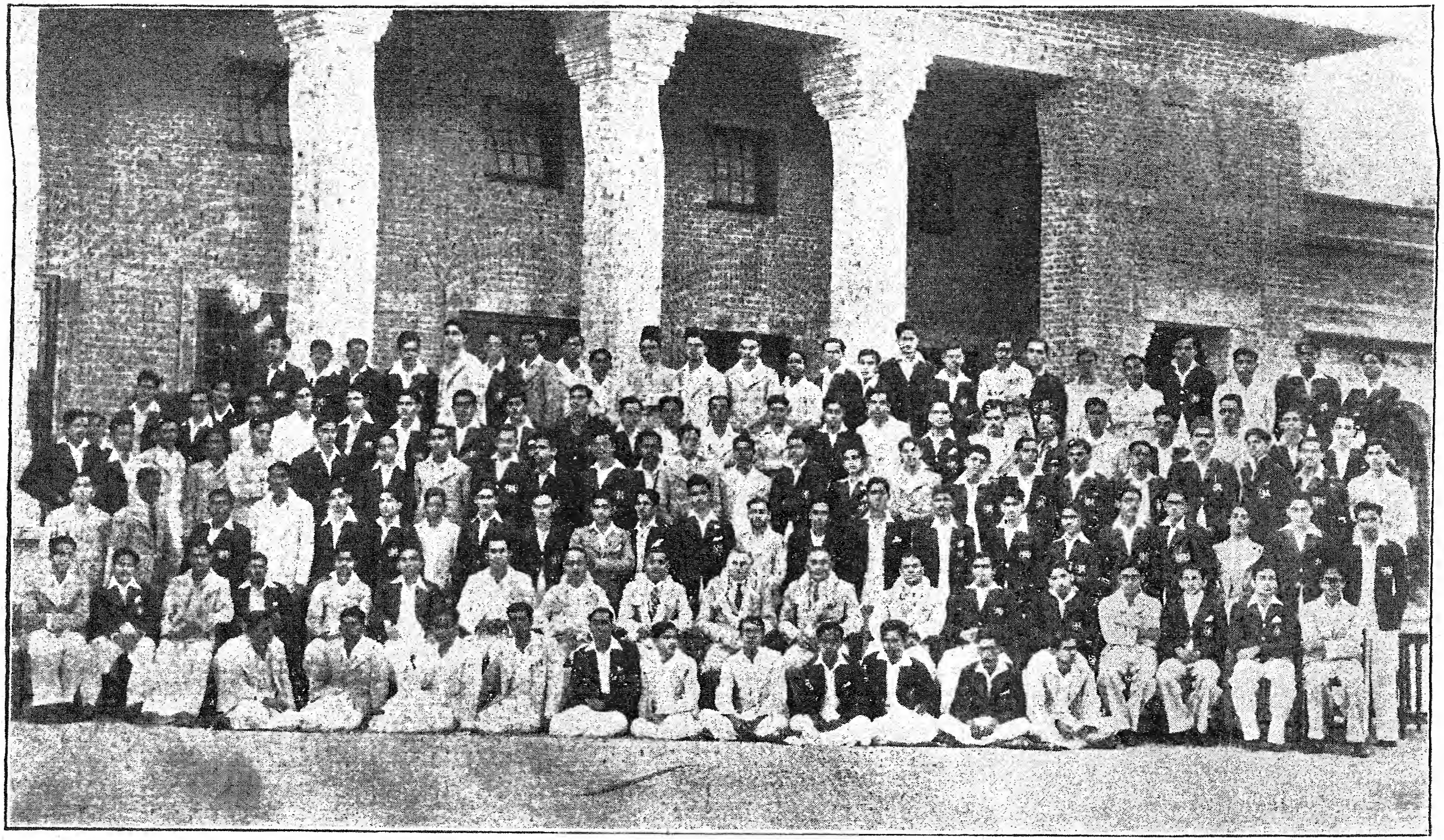
H. SHIVA RAU,

Vice-President, Students' Club.

The College Song.

Members of " Agricoll " Team
Ne'er fail to play the game,
Heavy though the odds may seem
Hold high the noble name.
Always look ahead of you
Ev'n though the goal is far
If to yourself you will be true,
Your success none can bar.

T. Chellappa.



Students of The Agricultural College, 1939—40.

The Tatler's Diary 1939—40.

1939

June 15. The College reopens.

„ 16. The regular grinding has begun with all its implications.

„ 18. Some Late Latifs arrive.

„ 19. The election propaganda seems to have begun.

„ 22. G. Raghavalu thinks it wise not to lengthen the mid-summer holidays. So he arrives here to-day.

„ 24. The day of election. All the candidates are busy canvassing. Mr. Baskara Rao is duly elected as the Badminton captain. The hostel rejoices over his victory. The deserving man always wins.

„ 25. The elections are over. Thank heavens! All is quiet on block-fronts.

July 3. I year Class is formed.

„ 4. M. Hegde has arrived. Even the most optimistic has now to believe that the Agricultural College has reopened.

„ 13. The College Day and Conference is opened by Hon. Mr V. V. Giri. K. Bhaskaram creates a record by bagging 4 prizes of the II year class.

„ 16. G. H. Madhuram sees the first picture in the freeman Hall. (Shown free).

„ 25. Ananthakrishna Rao of the I year gives a lecture on 'Manners' behind the 11th Block.

August 1. The Tennis courts are reopened by the Principal with the addition of one court.

„ 2. R. Veeraraghavan has the honour of being defeated by Sri. Bobjee.

„ 13. Bhaskara Rao wins over E. V. J. Cunha and proves his mettle.

„ 15. Sri. Sundareswara Iyer, Headmaster of the Wardha School gives a lecture on " Wardha Scheme." A purse is presented to him by the Agricultural College students. M. Sulaiman presides.

„ 19. Election of student representatives to the M. A. S. Union takes place. K. Rajasekara Shetty, T. Kailasa Rao and K. Ch. Vengala Rao are declared elected, amidst deafening cheers of 15 members.

„ 21. Sreshta and Ramasubramanian, the reprentatives of classes III & II respectively leave for Orumanayoor,—Carrying the gifts and good wishes of the students to Mr. & Mrs. Verghese.

„ 22. Usman, Class I wishing not to be out-done by his seniors, leaves for Trichur. He hopes to reach Ormanayoor before Mr. Verghese joins duty here, on Wednesday.

„ 23. Sreshta and Ramasubramanian come back safely. Sreshta opines that Cochin is really a place worth visiting.

„ 24. The Botany section has run short of pith. The lecturers in Botany meet to consider as to how best to meet the impending pith crisis. They have finally called for tenders from the following gentlemen for the supply of their old pith hats.

K. M. Ayyappa.
M. R. Mohan Punja.
Madhuram.
Sumitra Rao Ullal.

Stop Press.

24th August—Mr. Usman and his two lieutenants have arrived safely after being nearly lost in the Waliyar Forests.

Sep. 3. England declares war on Germany. Agricultural Students see a prospect of postponement of the quarterly Examination.

„ 5. Students hear the War news. A noise like the roaring of an aeroplane overhead is heard. All the students run into our A. R. P. Shelter (Sports material room). Bold Ayyappa goes out to investigate and finds that it is not an aeroplane but only the Entomology Lecturer's car.

„ 13. The periodic curse of exams. coming up again.

„ 15. Jubilation in the Hostel. Holidays commence. The happiest day of the term.

October 1. Our sportsmen leave Coimbatore on a games tour. The reopening of the college in prospect. Wits are put to test. A rush to the doctors in various parts of the province for medical certificates for extending leave.
Final year students start on their educational tour.
Thank goodness, the war did not affect their tour.

„ 4. College re-opens. Cheerless faces in the class rooms.

„ 5. The drudgery of regular classes commences. The warning bell for afternoon classes. Some lecturers disturb our sleep.
3rd year students at Courtallam water falls. Every body enjoys the bath. A noise like that of a steamer passing by is heard. All students turn round and find Bhasker Rao frantically beating his limbs in water. All run to his aid but are discomfited to know that 'M. V.' was just swimming. According to this champion swimmer, swimming is all noise and no motion.

„ 6. 3rd year students at Trivandrum. Several of the students are recognised by the denizens of the Zoo. Sreshta shakes hands with a chimpanzee. A giraffee accosts Veera by bending down its neck.

„ 9. At Cape Comorin. All except some shy bathers took to water. K. S. Ramaswami performs "*Sandyavandanam*". He thinks he is nearer heaven now by at least a mile and 210 yards.

„ 11. Leave Quilon for Ernakulam by the back waters. A cheery journey.

„ 12. Reconnoitering the port of Cochin.

„ 13. At Trichur. Visit to Central Farm. Students start on an endless walk. Sreshta asks how many more miles they have to walk to complete the circle round the world. Not much anyway !!

„ 18. 3rd year students return to Coimbatore. Havoc of heavy rains.

„ 19. All the beddings transported in the open double bullock cart (*kindly supplied by the farm*) from the Railway station to the college, hung up for drying.

„ 23. Janab Md. Sulaiman becomes the 3rd year class representative by common consent — a happy choice indeed !!

„ 27. Bhasker Rao has disturbed sleep because he had to arrange a badminton match the next day. 'M. V.' now knows what heavy responsibility—the Badminton Captaincy involves :—Hitler would have shuddered at the very mention of it !

Nov. 1. K. Sheenappa, the west coast Mess Rep crosses the floor and goes to the General Mess. Diplomatic circles opine that he goes on a mission of proselytization. We wonder whether he will succeed in enlisting recruits to the West Coast Mess.

„ 4. A dozen students are called for an interview by the Principal. A miniature viceregal interview !!

„ 7. Hockey match between our college and St. Joseph's ends in a draw.

„ 8. The drawn match replayed today. Great anxiety prevails—the inevitable happens. Our College loses by 2 to nil. Our secret service men inform us that the voice-box of many a Government College student was seriously dislocated.

„ 15. K. S. Ramaswami representative of the General Mess changes over to West Coast Mess probably as a counter move to Sheenappa's propaganda campaign. Well done 'K. S.'

„ 18&20 Cricket match between our college and the American College, Madura results in a victory for our team. We congratulate our cricket captain as also ' S. V. ' for their remarkable display.

„ 24. Prof. K. C. Ramakrishnan gives a lecture on "Consolidation of holdings ".

„ 25. Second lecture by Mr. Ramakrishnan.

„ 26. Dr. Muthulakshmi Reddy addresses the students :— Students perturbed at a wide divergence between the subject announced and what the lecturer talked about. Mr. Ramakrishnan surprises the audience by saying that cricket is the anathema of a college student. He would have rued the remark if he had told the same to the Pentangular audience.

„ 28. A debate in the Freeman Hall. Rajashekara Shetty presides. Mr. Kanti Raj is the observer. Attendance poor. The long succession of meetings we had, is evidently the cause. The speeches of Venkatarathnam and Sundararajan are punctuated with cheers.

Dec. 1. General Mess goes down in membership from 45 to 16. West Coast Mess displaces General Mess from the main dining hall.

1940

January 1. G. V. Chellappa makes a new-year resolution, not to make any more resolutions.

„ 3. Second year students start on their educational tour to the West Coast.

„ 5. The world record for climbing down a coconut tree is smashed by Jagannathan by falling down from a 30' coconut tree at Kasargod in exactly 1 1/98 second.

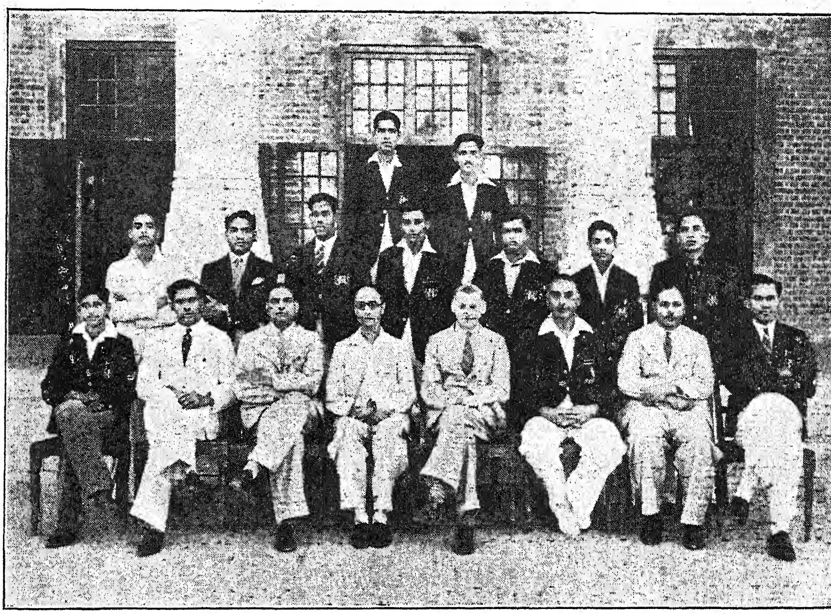
„ 9. Selection exam. results announced ; no detentions in the II and III years.

„ 12. Second year students arrive at Coimbatore after completion of the tour. The students defy the jutkawalas and cover the distance from station to estate on "shanks' mares"

Mr. P. A. Venkateswaran, the leader of the party looking like a veritable G. O. C.

„ 15. Foot ball match between I & III years. Mr. C. Ramaswamy after witnessing the match, says, that any day Murthy-Raju will find a place in the All India Rugby team.

„ 16. Rajasekhara Shetty on getting up, finds, a big bundle in his room with a slip attached to it, which runs as follows "Herewith, your cycle R. I. P. (Sd.) Ananthakrishna Rao." From this, Shetty has to gather that Ananthakrishna Rao to whom he had lent his byke must have had an accident.



Members of the Executive Committee, Students' Club, 1939—40.

The College Hockey Eleven.

The College Foot-Ball Team.

The College Cricket Eleven.
Runners up in The Madras University Inter-Collegiate Cricket Tournament, 1939—40.

Dr. Burns gives a lecture on Agricultural research practices in India.

„ 19. Sir T. Vijayaraghavachariar adresses the Students' Club. Our cricket XI and athletes leave for Madras.

„ 26. Rev. J. D. Valois of the American Arcot Mission delivers the 1st course of University extension lectures.

Feb. 1. Victory Cup Hockey tournament. III years play against the second years and get defeated by 1 : 3. Ramasubramanian—very tired after the game, for he was one of the line umpires.

„ 8. Hunt for a man to preside over the club-day begins. Hard time, indeed, for the club secretary and the vice-president of the club.

„ 17. Club day sports — College maidan teeming with hundreds of people.

Inter-mess tug-of war, the most interesting item. Andhra mess wins proving beyond any doubt, the superiority of a vegetarian diet over a non-vegetarian diet.

„ 24. Club day. The grandest event of the term—variety entertainment put up by the students very much appreciated.

„ 25. After effects of the happy day that preceded. The Hostel gloomy-students think it is high time they take to studies.

March 1. The arena of activity of students has shifted from the club room to the various blocks. Students busy with their books.

Some of the optimistic fraternity think, they can easily make amends for their comparative inactivity during the rest of the 11 months of the year, if they work for 23 hours per day (Figures arrived at by Murthi Raju.)

"The Struggle of April".

TWO months of sleepless nights! Every day the familiar faces became more and more strange with overgrown beard. Each morn was the scene of sunken and ruddy eyes recalling a riotous night. At every moment emaciated frames emerge out of their dens frantic with mental load and vomitting into the air what they acquired in the night. While some were engaged in gossips of their past adventures, the more professional mugs were busy finding out a more lucky den.

The 3rd of April—the eve of the struggle came with its usual stride while the tide of unceasing cramming was proceeding with redoubled vigour. Life seemed to be absent in our camp which was forty strong. Every one with a book in hand was in deep meditation as if to win the Universe. While many lingered on their way to the mess, some flew to get charged with fresh ammunition. The night fell, little or no food was taken by the members of our camp. Every den was occupied in time, the occupant busy preparing for the impending struggle. The desire to face it bravely made several of us become immune to the fear of mid-night ghosts.

The next morning—the beginning of the theoretical phase of the enterprise saw us bravely facing it with unflinching courage. Never did we feel that we would be taken prisoners, if defeated. The fight of the day proved to be a success by the number of cheerful faces rushing out of the hazardous arena. The struggle was renewed on the succeeding days and fought with effect. The set-back was received in the field of Chemistry-a defeat to be remembered by all. The burning of the midnight oil proved to be of no avail, when most of us failed to answer the challenge. A good many of us grew desperate while some kept on turning the challenge sheet in a pensive mood—the fate of the jackal holding the tortoise and searching for its head to get a grasp. The hitch continued for full three hours; several of us received serious injuries threatening our fall. With heavy hearts we retreated again to our camp hoping to struggle with greater valour in the practical phase of the fight.

For unknown reasons there was lull in the camp for full six days and we lost no time in getting the sufficient reinforcements to continue the fight to a successful termination. The practical phase of the struggle began in right earnest. We had to battle both within the arena as well as in the open field. Here again to our greatest disappointment, the fight in the Chemistry arena stood in the way of our hope for success. Many of us had to take to A. R. P. shelters to escape the gassed area while some had the misfortune to receive local burns. A few including a bosom friend of mine received fatal wounds. The fight continued for two more days and our last day's encounter was

confined to an open field. We had to cut through unseen foes at the direction of our Commander and we did fight with patience at the sacrifice of our dear sweat, if not life. The battle was short and I was the first man to receive a gash.

Uncertain of the result of our doings we retreated from the field of action to our base for a little rest, when we received orders of a well earned home leave. It was gratifying that the efforts of our company were commended by the Head quarters and some were mentioned in despatches for conspicuous bravery. But the inevitable happened and some of the company were lost in the struggle, for us to bemoan their loss.

K. S.

Immortal Love.

Distance cannot separate us
But lends an enchanting view
And puts us in communion with each other ;
Barriers of distance, we have broken
And none can fetter us !

O my love ! your beauty in the morning glory
So rapturously I devour
Forgetting myself and the world.
Your sweet voice in the chirping of the birds
To hear, I get up from my reverie.

Thought of you in trance I sit
Minutes, hours pass by
And I am lulled to sleep
Your sweet lullaby
In the babbling brook nearby.

Are you angry with me, dear ?
For I see your blazing eyes
In the midday sun's scorching rays.
I sit up to woo you, dear
Till I finally see you smile.

I see your calm smiling face
In the tranquil scenic beauty,
And I dance with delight
Till I see you fade away
In the darkness which fills every space.

A. G. Kesava Reddy.

It is a Topsy-turvy world.

I HAVE often felt amused at the way things go awry in this world. Alladin's lamp brought him the things he wanted, but in our case a mysterious something effects things which we do not want. Otherwise why should the penultimate Saturday synchronise with the studying mood that I seldom creep into. The rain ever makes it a point to come, when I go out in my best clothes. Encouraged by bright weather I think of donning my best suit and I actually go out, but, before I have gone half a mile it begins to rain, not cats and dogs, mind you, but whole menageries. So many times has this simple phenomenon occurred, that the weather clerk always draws up his weather chart in accordance with my holiday attire. Undoubtedly my best clothes are more reliable than the " cumulo-nimbus".

Now, as I scribble these lines, I see my time-piece before me. I see it, I said, for I do not hear it. It is evidently taking rest. Surely silence is golden, why ? I say it is radium itself, when, the hen-pecked husband, who returns home rather late. has to face a termagant wife. But such a silence is unbecoming in a time-piece.

The alarm side of it is simply tragic. It goes off at the most unearthly hours and wakes up the wrong people. Suddenly at 11-30 a. m. it sounds the alarm and the result is my next door neighbour wakes up. Once he is out of his bed nobody in the block can ever dream of a sound nap, for he belongs to the musically-inclined fraternity which pays the least heed to the feelings of neighbours. ' Music hath all the charms that soothes the savage beasts' says my neighbour as an answer to my importunities to him not to sing, I doubt not about the veracity of the assertion; but all that I want him to know is, that there is an ocean of difference between music as such and his efforts. But it is no use arguing with him, for once an idea gets into his grey matter, nothing short of trephining can bring it out. So I have decided to put up with his music, and the silence of my time-piece.

The other day, we went for boating, and the unlucky bloke that I was, I had to be satisfied with a place in dangerous proximity to the sail. Throughout I had a vision of Dante's inferno. I do not know how. The impression on the mind of the sail seemed to be, that we were enacting a funeral, and that I was the corpse and itself the winding sheet. That the boat did not capsize, I simply mention as a statement of fact: why it did not upset, I am unable to offer any reason. I have often thought about the matter since, and I think the result may have been brought about by the natural obstinacy of all things in this world. The boat may possibly have come to the conclusion, judging from a cursory view of our behaviour, that we had come out for a morning suicide, and had there-upon determined to disappoint us.

Often have I felt that there is a secret understanding between my cycle-lamp and the Estate Havildar. Whenever I go with a lamp the Havildar is not there but let me but forget the lamp for a single day and the Havildar is at the gate! So many times has this phenomonon occurred, that, now if I take my lamp, half a dozen of my friends go without theirs, for nine-to-one the Havildar won't be there.

Such is this world! and every object (animate and inanimate) seems to have secretly conspired to make man's life anything but happy.

Ah, how I wish I had an Alladın's lamp.

Upsidonia, B. Sc. class III.

The Girl with the Golden Hair.

I met her first at Variety Hall,
And then at Coronation Ball;
Whene'er I met my heart was all,
For the girl with the golden hair.

Along the beach she went on a rick,
Giving my heart a happy kick;
Alas for me, I could not speak,
To the Girl with the Golden Hair.

She a good ten and seven,
Looked like an angel down from Heaven;
And so, into my heart was driven,
A desire for the Girl with the Golden Hair.

With a face beaming like moon-light,
She sat in the rick, without looking left or right,
But in my heart was a regular fight,
About the Girl with the Golden Hair.

With sparkling eyes and a Cleopatran nose,
She was a study in her saree rose;
But, into my mind I had to force,
The picture of the Girl with the Golden Hair.

So, Editor, please do not swear,
But tell me from your comfortable chair,
Do you think we will make a happy pair,
Me and my Girl with the Golden Hair?

By C. Sankara Rao, B. Sc. I.

Our Idol.

IN any gathering of students—he goes un-noticed. Frail, medium statured, dark but not ugly, with a conspicuous nose which relieves his otherwise plain features—not prominent at anything in particular, but sure of many things perplexing to others—a slip of a boy is K. Bhaskaram—our idol.

Cool and calculating, debonair, methodical in his ways and moderate in his views—despising nothing and dominating none—a perfect bohemian—Bhaskaran is devoted to his duties as only a few could be. He has a weak frame but his worst weakness is for monopolising the first prizes in any subject he sets his heart upon. To attain proficiency in every subject of a class is not an easy matter but for Bhaskaram it is perfectly easy—as easy as he makes it. He has been a big stumbling block to many of us—these three years—but he cannot help it. Prizes go to him as the greedy flies to the candy, a bitter pill for many an aspirant for academic honours. He may not be a genius—but his 'grey matter' is made of a better 'alloy' than those of his compeers—a practical mind with plenty of practical wisdom.

Others are thankful that he has not exploited the field of sports—which branch he has left to those that have more of brawn than brain. Nevertheless, he is not a book-worm. He reads less—much less than many, but assimilates more than what a dozen could do, put together, and keeps himself physically fit by mild participation in many a game.

He looks grave but his looks are simulating. A simple mind—but fathoms deep—always alert—always responsive. He has developed a sense of exquisite aloofness which keeps the inquisitive at a distance. In the field of politics, his views do not matter, although it is indicated from his rare expressions that he sponsors socialistic ideas. In controversial politics, he does not interfere and has cultivated a studied detachment from wrangles and quibbles. He may be lacking in impulse or momentum in this direction but he has an unrivalled patience.

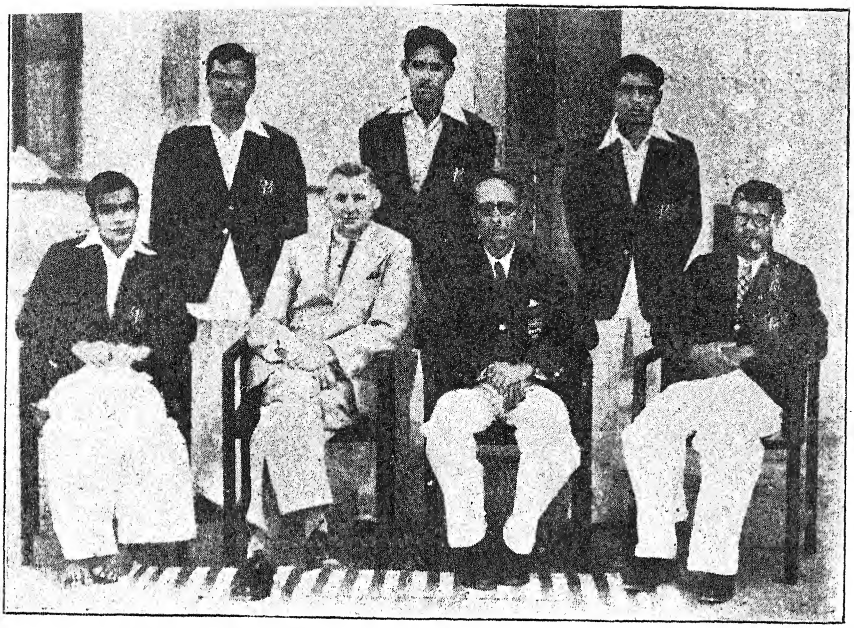
Two decades ago little Bhaskaram must have been chuckling in his mother's bosom but the present travail ducked him in the pool of matrimony and he is all drenched. We trust that this marvellous combination of several desirable qualities will do justice to the Arch Breeder of Nature and transmit the valuable genes to several generations of his progeny.

M. R. M. Punja, B. Sc. Class III.

Our Idol—K. Bhaskaran, B. Sc., III.

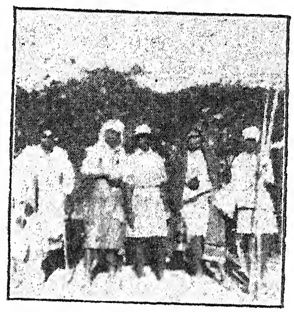
M. R. M. Punja,
Athletic Champion, 1939—40.

R. Veeraraghavan,
Tennis Champion & Winner of
Paralakimidi Cup for All-round
Sportsmanship.



The Men behind The Hostel Tatler.

C. Ramaswami,
the general Coach at the Nets.



Fancy Dress Competition,
1939—40.

Fancy Dress Competition, 1938—39.

A Ghostly House.

GOING along the Avanasi Road as you go to the heart of the town, somewhere on the left you will see, an old three storeyed building which must have been a palace of some rich Chettiar living in the near past. The building is not very close to the road but a few yards away from it and is islanded by a huge compound. This compound should have had a beautiful garden—the pride of Coimbatore. But now, we see only the more permanent features of that garden; as broken down water fountains, baths, flower trees, avenues etc.

This dilapidated house was said to have a reputation for ghosts, of which fact, Chander and I were blissfully ignorant as we had just then joined the Agricultural College and were strangers to Coimbatore. One day as we were returning from a friend's house, all of a sudden the sky darkened, and it began to rain in torrents. Looking around for shelter we saw no other place to go than this building. We cycled right in and waited on the verandah for the rain to subside. We found the house in a desolate condition with the doors left ajar and few of the window shutters wrenched off the hinges.

It was getting darker and darker—the time probably nearing eight and rain was getting heavier. The hostel rule that we must be in our rooms by 8-30 P. M. worked in our minds and I grew impatient.

"Say, Chander", I said "I do not think, we should wait for the rain to stop, as it is already late and it would be impossible for us to reach the hostel in time for food, if we waited. What do you say? Shall we go in spite of the rain?"

My friend Chander has an adventurous sort of mind and seeing the huge ancient building, did not like the idea of missing the prospect of a night's adventure. I knew what was in his heart, although he replied.

"What Prakash, don't you think it absolutely foolish to venture out in this blasted rain and get pneumonia for trying the experiment. I think, the warden will be more pleased if he knew that we sacrificed our night meal and stayed out for such a reason."

So, we remained in the house for the night. The rain had not only not stopped but seemed to increase in intensity.

Chander who had been sitting down thoughtfully for some time suddenly rose up.

"Prakash, come, let us explore this empty house; you need not be afraid; I have a torch".

It is true, I am chicken-hearted although I do not admit it. I had a premonition, that this building was likely to contain ghosts or the like. I put on a bold face with my chin right up and shouted 'Righto',

We crossed the threshold of the house and as we walked our shod feet resounded in the rooms we traversed.

What was that? I am sure I heard it—the sound of a door banging. I held my breath, while my whole body trembled.

"Wait", I just managed to whisper "Didn't you hear that sound?

"What sound, you ass"?

"That sound which seemed to come from there". I whispered indistinctly, while my teeth chattered perceptibly.

"Come on, don't be a goat" bawled out Chander and dragged me to the small room which contained the stair case leading to the second floor.

We had just gone to the second floor, when the same sound was heard again. This time it was louder and nearer. Even deaf Chander heard it.

"You heard it this time, Did'nt you, Chander?"

"Yes I did. But I think that it is some wind that is banging the bally doors".

It was about this time that the rain had abated and gentle breeze had sprung up which we felt through some of the open windows. Knowing this, I objected to his conjecture, attributing the cause to the slight breeze. But he quietened me and pulled me on. Suddenly he turned around and said "What is the matter?"

Then I remember wandering in the second floor for sometime, When all of a sudden, we heard steps coming down the stair-case from the third floor. We heard them distinctly and could count them; One! Two!!. Three!!!—!!!!

Everything became still. The steps on the stair case had ceased and by the sound of the foot steps we knew that somebody was coming towards us. At that time we were standing or rather pinned to the floor in the middle of a large hall.

At the threshold of our room the sound of steps stopped but, in floated a white turbaned figure of huge dimensions wearing a white garment similar to that of the peon of a Madras Minister minus his office sash. His eyes shone like two powerful lights and the rows of teeth sparkled in the darkness. In his black hand, he held a massive *talwar* and he moved slowly—very slowly towards us. While raising his formidable weapon threateningly, he began shouting some gibberish which I concluded was some old Tamil war cry.

Seeing the dreadful apparition, my knees rocked with great fear and I opened my mouth to shout. But I could not get my voice. I felt a helpless wretch. Then I saw the glistening *talwar* come down, aimed right on my neck, and it came nearer and nearer. My knees grew weak and in my confusion, I gave a shriek which would

What odds !
Oh, poor Agricultural Students !

Is your goal brighter ?

Darwin Contradicted.

C. S. Krishnamurthi, Class III.

have wakened even the dead from their graves. God only knows how I managed to find my voice again.

Every thing became blurred and through the haziness I heard Chander's voice faintly enquiring "

" How are you feeling Prakash "?

I slowly opened my eyes and looked around. Yes, I was still in the building. Chander was bending over me and wiping a wet cloth on my face. I then recollected what had happened and began to wonder.

"Chander didn't we go around the house "?

" Yes, we did, but keep quiet for some time ".

" Tell me Chander, please, what happened after that "?

" Alright if you promise to listen quietly."

" Yes, I do ".

" When we were going to the second floor, you again heard that voice and I pulled you up but unfortunately you slipped and fell down the stairs, a limp body ."

"Seeing you utterly unconscious, I grew alarmed. Being a trained scout I tried to calm my fears and carried you down to the first floor and laid you down on the verandah. I opened your buttons and removed all the pressure on the body. Then I tested your heart. It was beating low ."

" I switched on the torch and searched for any wound on the body. Except for the huge swelling on the fore-head there was nothing else. (Strangely enough I did not feel the swelling and so its presence had escaped me.) I wetted my hand-kerchief and gave you a cold fomentation. I think you had better sleep on. By the morning you will be fit to ride back to the Hostel. Instead of an interesting night, you have given me an anxious one". (But wasn't it an interesting one for me ?)

I have not told Chander my dream, but if he comes to know about it he will start ragging me as the chicken hearted warrior.

N. J. Sreshta, B. Sc. Class III.

Personalities of the Day.

VERY rarely is a Prophet honoured in his own times. So is the fate of a genius. Either his greatness is completely ignored or recognised only when it is too late, perhaps not earlier than his consignment to the cold marble. The world recognised the greatness of Jesus, the purity of his soul and the high philosophy of his preachings not when he was alive, but only after he sacrificed himself for the "betterment of the humanity." The world paid homage to the brilliant intellect of that "illiterate genius and philosopher" only when he was no more; of course I am referring to Shakespeare. But this is only one of those accepted axioms, always accompanied by those noble exceptions which go to prove the veracity of the rule. For example our friend Dr. Graham Sullivan is a living example of such exceptions. The village school-master openly admitted the precocious intelligence of Graham, the boy. Now the world accepts without the least hesitation, that he was a genius, he is and he will continue to be so as long as he lives....

He hails from a remote village, a point, which he shares in common with most of the great men of the day. He will be twenty three next July. He is a blooming guy of perfect build and medium height: his cheeks are ruddy indicating the perfect health he enjoys; his lips, though of the 'bloated type' are cherry red. In short, he is a handsome youth with an attractive personality. As a matter of fact that is the reason, why he was popularly known as "Robert Taylor" in his College...

He was educated at the "American College" of the London University and he took his "Bachelor" degree in his eighteenth year. It would be impossible to attempt enumerating here, all the academic distinctions he won at the institution, during the short period of his stay. Suffice it to say that he was known for his oratory and he filled the Presidential chair of the London University Students' Club, on several occasions. Unfortunately I have nothing to say about his sporting activities but he was the winner of the trophy for "All round inefficiency". In this connection it would be interesting to know that he has claims to be the winner of the 'Tennikoit County Shield'. Circumstantial evidence being absent, let us fervently hope that it is not far from truth. By Jove! I forgot to tell you. In one of his weak moments he confessed to me that he tried "Tennis" for 4 years in India and gave it up finally at London, in utter despair at finding no improvement in his game.

Soon after his return to India in 1937 a Doctorate was conferred on him by the Aligarh University. We are kept entirely in the dark

as to the subject he chose for his thesis. Never commit the folly of asking him about it, if you meet him. He is very sore when any one mentions the topic. Of late he was elected the "lifetime Secretary" of the Methodist Club (by the way I may tell you, it is a human miscellany, a curious conglomerate of discordant and incompatible individuals who agree only to differ from each other). Since his entry into the Methodist Club, he has eclipsed Colonel Bore, who was till then the dominating figure of the club. He is always complimented in the club for the choice of his toilet materials and the smartness of his dress. But personally I would have liked his dress but for the alarming shortness and gaudy colours of his coats.

Dr. Sullivan, as you know is a good conversationalist and a strict believer in "Johnsonian labour". He asks us to believe that in this wide world there is not even a single subject in which he is not well versed. He is all-in-all and talks with authority on every topic. His arguments are, more often than not, unconvincing and queer and as unacceptable as a vegetable bitter. If he succeeds in winning over an assembly to his side, it is by virtue of his high sounding language and richness of his vocabulary and not due to the strength of his arguments. Very rarely can we rely on what he considers as an established fact. He is not worried in the least if his arguments are disproved or his statements shattered. Bluffing is his strength.

If Dr .Graham does not approve of a proposition or accept the truth of a statement, you can be dead sure of the contrary. The above rule is reported to have constantly given cent per cent success till now. He has of late resorted to patriotism. Now a days he wears only khaddar. He has begun some constructive work in his village for the betterment of Agriculture. Just now, the local correspondent of the Tatler rolled into my room to tell me that Dr. Sullivan is the recipient of 'Rao Sahib' a New year honour—rejoice, revel, on this happy occasion. Cheerio readers ! we shall meet again very soon, if the editor permits me to present to you Colonel Bore.

Saliak, B. Sc. Class III.

The Dream of "Mars"*

IT is with great pleasure that I give you here an account of the recent dream of "Mars". I hope you will enjoy it by reading and feel cheerful as much as I do when writing this.

It puzzled me many a time, why man should not have been created in a different way altogether from what he is at present. The following idea struck me when I was inoculated a few days ago. My hand began to pain awfully and I could neither eat nor read, nor do anything satisfactorily. If I began to read, my hand would begin to pain immediately. Why should it pain ? Because the hand was in league with the brain and it would communicate all its sorrows and pleasures to the brain. The brain, a sympathiser of all the other organs of the body, would either weep or laugh according to the situation, so that, when my inoculated hand made an application of its grievance, to its seat of Justice, the brain began to weep, the eyes began to water, and the mouth began to sound. It was then that the idea occurred to me, why the various parts of the body should not work separately, without the help of any other organs. This idea took hold of me like a devil, and I worked it up hour after hour and day after day, until at last I have come to a conclusion.

Physiologically, the body of man has been divided into the head, the trunk and the limbs. These parts work as a harmonious whole. If any part of the body is affected, at once the mind becomes conscious and it feels sorry for its co-organ. The mind seems to have a parental attitude towards all the other organs. For our purpose the physiological parts of the body have got to be sub-divided. The head for example, into the ears, the eyes, the nose, the mouth etc., and the limbs into the legs. the hands etc., Supposing the human body had been created in this manner, then each organ would do its business quite independently. Then man would have been a different animal ; and this is the wonderful, imaginative being, the man as he ought to have been, that I am going to portray below.

According to this system, the eyes, the hands, the brain etc., are all separate ...each working by itself. Then it would be very convenient to all of us. We shall prove some of the merits and at the same time point out the defects of this system. First with the merits.

Many a man is called intelligent because he is a book-worm. He gets a first class in an examination because he has been a book-worm. We are sure that most of us could get the same thing if we had also been book-worms. But we are better than that. We are jolly-good-fellows, 'The Idlers' in the words of R. L. Stevenson. But if the body

* 'Mars' is the pen-name of the Author.

had been made up of separate and portable parts, every one of us would get a first class very easily For, you can place your head (Brain) and eyes on the table and ask them to study all the twenty-four hours of the day if you like ; but at the same time you can be doing some other work with the other portions of the body. If an examination were held then, we cannot blame our fates that we were busily engaged in unavoidable duties of household and others which took away much of our time. For we can do our household work and study our lessons at the same time.

Whenever we go late to the College, our grievance is that we are not fed in time. But if the imaginary man is created, you can ask your stomach to sit and take the meal, while you can send your eyes, ears and brain to the College bench, to hear the lecture. Certainly a boon to students.

Many business-men of to-day complain that they have no time and most of them have not found a solution to save time and this idea seems to be the correct solution.

We are extremely sorry for the poet who wrote,

‘ One thing at a time and that done well
Is a very good rule as many can tell"

For his theory would be shattered to pieces if the imaginary man becomes a reality. We can do many things at the same time and that too well. It seems to me that it was perhaps with the idea not to displease the poet, that God created man as a harmonious whole.

These are some of the merits. But what about the defects ? We may no doubt agree that the idea is very good, but we have to consider the de-merits as well. Why did not God create this new kind of man? Really the idea never occurred to him. We are absolutely certain about that.

We shall now suppose that this new man is created. Then it would be impossible to find out a thief. If a man stole a thing-whom could you accuse ? Perhaps it is the hand that stole the thing. You would certainly accuse the hand of the crime. You may even prosecute the hand. But the criminal does not care much if you prosecute one of his hands. He has got the other hand for his use. The loss of one hand would not at all be a very great loss to him.

Secondly, the Penal Code will have to be revised. The section under capital punishment will have to be removed altogether from the code. For, whom could you hang ? You could hang only the neck. The other parts of the body, it would be very difficult for you to search. The criminal is very clever. Therefore when he comes to know that he will be hung, he would keep his neck on the scaffold, send his head to England, his limbs to America, eyes to an opera, and

his belly to a hotel ! It would therefore be impossible for the hang-man to collect all the parts of an individual and hang him completely. In fact the hang-man will have to be himself hung many a time for committing illegal murder ! For, there is every probability that he will bring the eyes of one man, the belly of another man, the hands of a lady and make a mess of it and thinking all the while that he is hanging the right person. In fact he will be murdering certain portions of the body of A, B, C, X, Y, and Z, so that the section on hanging will have to be altogether removed from the I. P. C.

We now see how good the idea is. We shall make a written application to God to give us the benefit of this idea. If the reply does not come within about a week, we know what we shall do. (We shall all separate the organs of our body and at the same time go on Hunger-strike.)

We shall send an ultimatum to him.

B. Narayana Reddy B. Sc. Class III.

Believe It or Not

The craze of challenge being over, Sreshta thinks it wise to play Tennis now.

R. Veeraraghavan has submitted a thesis on ' How to break promises honourably ' !

While Gokhale was titrating, K. Srinivasan actually slipped into the 2,000 c. c. beaker and was all but drowned.

D. Narasimham and Sanyasi Rao have been chosen to represent the Agricultural College at the All India Bus Owners' conference to be held at Salem under the Presidentship of Mr. Appaji Rau, Asst. Steward.

K. V. S. Suryanarayanamurthy is busy compiling his "Tamil made easy".

The Hostel rumour has it, that Messrs Chaynulu and Narayana Reddi have been recommended for the Nobel prize for peace. W hope they won't be bracketed.

Between Big Bull and the Tatler Correspondent

Big Bull was moodily chewing his cud in a corner of the yard. I approached him with all the politeness of a news correspondent and,

Corres. Hollo Big Bull!

Big Bull answered me with a frightful toss of his head.

Corres. Now, Big Bull, you are repeating one of those pranks that does'nt benefit a fellow like you. You know you are the bulkiest chap in our estate and bulk, I tell you, always has gentleness about it!

Big Bull Sorry, but I thought you were one of those people, they call themselves as B. Sc. Ags., the very sight of whom makes my hump shudder.

Corres. And pray, what *may* be the cause of this all?

Big Bull My hump! You have an innocent face my friend. It all happened the other day, Wednesday if I remember right when I was mourning over the death of one of my beloveds. (Big Bull presented a sorry figure, his face upturned in thought.)

Corres. And shall I know what bad luck actually befell you that day?

Big Bull They all circled around me—those wretched people—the scum of your society and what not I call them and began insulting me. Pinched me here and there and croaked and laughed. The devil take those words, 'Mandibular joint' said one, 'Point of the buttock' said another, 'Carpse' croaked a third. And one rogue pulled my tail—ho! my hump and horn! How I hate to think of it! I raised my left leg, bent upon teaching him a unique lesson; and hush—he ran away (Big Bull laughed a cynical laugh) and a plump fellow, he had a squint in his left eye, he called me 'Poor fellow'. I did'nt like the word much. (You Know).

Corres. Is that all, my Good friend?

Big Bull Not a bit Sir, do listen. They brought damned things, 'bandages' they called them, and tied them round my legs. Bandaging an unwounded, healthy fellow like me! hum—how they dare do it! I bit the cursed thing when they all went away, bit it until it was all pulp. My hump! That's my spirit!

Corres. My Big Bull, you are entirely mistaken I tell you. You know they do it for your own good, I mean your own people in the broadest sense. They just get familiar with your

own make and after that they will do good, good, and nothing but good, good for you, good for your beloveds and good for your sons. You follow me?

Big Bull Not much. But for your sake I'll be better mannered hereafter.

Corres. Righto! and now to the matter in hand. You know I have come to get some information *about* yourself.

Big Bull Pardon me if I ask you to take up point by point.

Corres. There I have a good fellow! First of all let me know your age.

(Big Bull opened his mouth and kept silent).

Corres. Thank you. Your weight?

Big Bull Dear Sir, I ask your patience in that matter.

Corres. Well now, Big Bull, I am afraid we are facing a more personal question. I know your gentleness will not allow you get angry at a fellow like me. May I know how many beloveds you take per year?

Big Bull Things were alright chap, but of late, I have had some misunderstanding with the Surgeon and I mean to take up a wholesale strike in that matter.

Corres. My good Bull, that would be too radical to be sure. But do tell me what is amiss here.

Big Bull My good Sir, hear me. My daughter, my poor dear miss, she was murdered and by the surgeon himself. Oh my hump! that love's labour should be lost! Buhoo—

Corres. Anything else, my chap?

Big Bull Yes Sir, and much of it. He laughed louder than others the other day and poked a cursed instrument into my mouth. I couldn't do much but gape at him, my mouth wide open. My hump! I suffered much.

Corres. My friend, I am at a loss to say anything here at present. But I do promise to speak to him and set matters right. But in the mean-time, do give up the strike.

Big Bull Yes, and for your sake, mind you.

Corres. Thank you. Shake hands.

Big Bull Shake heads.

On Sleep

" Early to bed and early to rise
Makes one healthy, wealthy and wise."

Thus runs a copy-book maxim set to our ink-stained youth. Like many others of its category, this has a ton of truth in it, but some inner voice prevents me from swallowing this doctrine entirely. In regard to the " early to bed " part of it I heartily concur with the poet, but the latter half somehow stinks in my nostrils and no amount of argument will ever make me an early riser. You may tell me that only early risers go to heaven. In that case I prefer to be in hell.

Now coming to the first part of the maxim—I am not a night bird. I simply love my bed. I know that insufficient sleep makes a man pale and sallow and I always aim at the peach-bloom complexion which comes from a sensible twelve hours between the sheets. One of the eminent doctors—I forget which—once said, that a certain number of hours' sleep each night—I cannot recall at the moment how many—makes a man something—which for the time being has slipped out of my memory.

But alas, for the student, who is dogged by ever-recurring examinations! Can he ever retire to bed early? Certainly not !!! It is indeed these examinations that ruin the health of India's youth. I have got a lot more to say against this inhuman system of examination, but I think I had better be silent on that rather touchy subject.

O, sleep, thou nature's balm
What harm has not been done to thee
By the wretched examination.

Were not these lines a spontaneous poetic outburst of a student who was preparing for an examination? Oh! what an uphill task it is—this fight against sleep. You requisition the help of all your oratorical powers and try to convince yourself, that the examination is close at hand and that you have got to read. Well so far so good. You enter the room all right—why, you actually take the book and start reading. You cover a page. Now comes the ordeal. You soon find that something is wrong somewhere, for you proceed with infinite slowness. Somehow you find yourself stranded at one sentence. To use a more common simile, your eyes remain glued to a sentence like a postage stamp. You become desperate. Doubts arise as to whether, it is not better to fail in examination, than to secure a pass at so great a peril to your health. Well, the next step is the inevitable one of switching off the light, and thus ends the travail, happily no doubt, but with far reaching repercussions on the marks-list. How foolish indeed of those moralists to say that " well begun is half done " and all that sort of stuff.

I have often wondered why our College hours begin at 6-30 a. m. I simply cannot understand the rationale of it. I think the time-table must have been drawn up by one of those insomniacs. Otherwise there is absolutely no reason why they should insist on so early an hour as that. Whoever has not felt that the early hours of the day are best spent beneath a snug shawl. Oh! to be supinely lying on bed—to be a lotus-eater for a while—to be feasting oneself on the chimerical visions and contemplating on a hundred and one sweet things—among others of the miss next door who had cast a sheep's eye on you. It is simply marvellous. It is indeed with a sense of pity that I look upon these human larks for whom the day begins at 4 a. m. for they deny themselves some of the happiest hours the Almighty has given to man. As for me it is simply impossible to get up in the early morning, not that I have not tried, but my attempts to rise early are simply a list of failures. I feel I can keep out of bed alright, once I got out of it. It is the wrenching away of the head from the pillow that I find difficult and no amount of overnight determination makes it easier.

Coming to a consideration of those men who suffer from insomnia, I have often wondered, how there ever could exist such a malady, when a science called plant chemistry is in existence. You think, reader, that it is a 'terminological inexactitude' and that I ought to have said "medicine" instead of "Chemistry". But I stick to my word "Chemistry" still. Indeed, plant Chemistry can do a lot to alleviate this human affliction. You wonder how there could ever be any connection between Plant Chemistry and Human Pathology. It is quite simple. My grandpa was suffering from insomnia and now he is a veritable *Kumbakarna*. Must have started taking bromide mixture, you may say. He did nothing of the kind. All he did was to start reading my plant chemistry notes and Lo! what did I find! In a trice he was snoring and snoring terribly. Yesterday I received a letter from him and he says that my notes are a wonderful panacea to sleeplessness. "Why even the baby stopped crying and slept soundly when I started reading the notes aloud", he says. A glorious tribute to plant chemistry no doubt, but one, I can say at which Physiological chemists will start.

"Hail Kumbakarna,
May his tribe increase!"

U. Sumitra Rao. B. Sc., Class III.

Blue Book of the Hostel

THE Hostel is a combination of the most varied and unrelated elements. Amidst all the bewildering details,—an account of which I have herein given, - it is a system with unity in all its diversity. I came as a welcome friend into this cosmos of the heterogeneous.

When the dreams of youth are not yet at an end, the College life is as good as being buried alive for the long span of three years, understanding what we can, swallowing what we cannot. We are all ears and no tongue, grave as owls, never smiling, never joking. But, once out of the portals of the College, our innate fascination for all things of the vagabond order is at large.

Hostel life has thus greater attractions. To return and find that our room had been visited by a typhoon, to behold our mirror with the contents of a full tube of Neem tooth-paste smeared all over it, and the boot-polish in the pomade or snow bottle, to discover some hideous figure reposing with ease on our bed, to find our black shoes meticulously polished with ox-blood or vice-versa,—or to find all our belongings labelled at 'sale prices' and hung up in the room to represent a shop in a by-lane dealing in second hand goods,—these are just and mild jokes at which we are compelled to laugh at if we could, and weep over if we could not. Locks prove useless when hammers and files and screw-drivers are about. The poor electrician is always kept busy repairing burnt fuses, the culprit however invariably remaining anonymous.

The cynical world looks upon us as Bohemians. We are not bothered about it ; we go our way, with perfect ease, undisturbed, and care two pin's heads, for anyone. The tempo of our age has quickened to a pace, which makes 'thinking for the morrow a tedium. Still our philosophy in a nut-shell is this ! ' The world is so, full of a number of things. We are sure we should be happy as Kings'. Perhaps, our opinions rarely (or never?) tally with the rest of the material world. Happy are we who are growing up and growing get used to our own life.

A lot of bunk has been said and unsaid about our Hostel politics If a stranger who does not know our ways were to hear us talk, he would think us awful fellows. The language ! in a court of Law—they would nearly hang us for it. But as I see it and know it, our politics are more elementary, less purely political than that. In theory, we are out-and-out socialists ; but in practice, we want silk pyjamas, superlative soaps, manicure sets and toilet requisites of an ultra blonde. Perhaps with some, socialism is a hobby.

Geniuses,—people who make history are not rare among us. But idiots of the superlative best, who stand at the other extreme of humanity, are not wanting. There is a perpetual race to do a supremely silly thing going on, for his name will take the precedence of every

other for a day or two ; and he counts on a large return in publicity. At an absurd statement from an absurd student, we all roar with uncontrolable laughter which sweeps away all other considerations. There are people who would do almost anything to get into the news. The lure of notoriety exploits the human frailty and they do almost anything. This, often in the long run does mere harm to manners and morals. I speak with a feeling, because it seems that this sensation is a poison which saps both decency and intelligence and is deadly insidious. The reason is not far to seek. This desire is latent to a lesser or greater degree in most of us, like the desire to fall in love or to peer into an automobile. It is not strange that an average man of no great parts, is susceptible to this temptation. Some of the world's greatest and strongest minds have done no better. Is it not Garibaldi who proudly said on being outlawed with a price on his head : " It is the first time I have the pleasure of seeing my name in print".

The most enjoyable part of the day is the late evening and the hour following dinner. The glamorous hour between dusk and dark is looked forward to with a thrill. Hearken ! there our wonderful radio, thrilling one's fibres ! How glorious and immensely soothing it is to sit after our day's toil and hear the unseen music, whilst watching the blue tinged smoke drifting heavenwards into thinner air. Eternal bliss !

After dinner we divide ourselves into various groups, each party having something in common with the flock such as smoking, snuffing or chewing ; but all of us have in abundance that stimulating sense for scandal; thus while the former is ephemeral, the latter keeps us on together. We go on in this sprightly manner till 9 p. m. and humour rocks us on and it goes from soul to soul, until the whole multitude rings out in an universal outburst. And then it ends, momentarily all of a sudden. The warden is sighted ! Silence, ominous silence prevails over us for a brief span till the warden turns his back and is at a distance out of hearing. All too soon we resume. Our talks are variously diverse. But we talk for enjoyment and not for admiration. We live so little a life of our own that other people's lives take the first place in our thoughts. Or, perhaps, we are too interested in others to be sufficiently interested in ourselves. A good deal of legitimate fun is made at the expense of our College intellectuals.

Needless to say that our discussions are promiscuous. Some profess a polite interest and dicuss with great concern about fantastic subjects like ladies' wares. We are at our best when our talk drifts on to the 'decorative sex'. The latest discussion was about the most useful finger to a lady. It was generally agreed after prolonged discussion as usual, that the 'little finger' is the most useful, for, round it she twists her husband.

Our tete-a-tete often drifts to the problem of marriage and what kind of girl each one of us would choose to be the apple of our hearts.

Our tastes are different. But we behave with decorum and serenity and parliamentatively when such important matters are at hand. Each man's choice is voted for. If any poor fellow chooses to disagree with the majority, woe be to him; the majority wish will be forced on him, for the majority opinion is always indubitably unbiased. Thus a man of short stature will have a girl of colossal height, so that he may feel with satisfaction as if her height were added to him. But it is with dismay I observe that all of us in spite of our ardent seeking, could not pitch upon a girl correspondingly short to suit our "Tall Man" and for our " man in black" a girl all fair. All these decisions are obviously taken after deep deliberation with full cognizance that 'opposites attract each other'.

Now to more mundane and everyday affairs. Bath-room *Bhagavatars* are more numerous than people with clean chins. 'Music has charms' the monkey has said, as he rattled his tail in a jam tin. And this charm of music soothes the solitude of the bath-room. Our tunes are not those of the 'pied piper' who could upset a community, but like the music of the crow by a running stream.

If heaven is anywhere on earth, I believe it is here in the dining hall. It has no music, but is full of rhythm, which helps men loose their wits. We take the extra-ordinary chance for the true enjoyment of the little leisure. India, nay the whole world may be moribund, yet, we like John Brown's soul, go on with fun, frolic and little pranks of humour, sarcasm and wit. Thus under the small roof of the dining hall, covered with food and noisy with chatter, each man in turn narrates his little encounters, but no narrator is permitted to get to the end of anything unaided.

Thus we have an innate fascination for the vagabond order. We have that infinite capacity in abundance to go where we will and do what we please. We find a strange pleasure in herding together whether watching a match, in a cinema theatre or cycling about the streets, we are distinct by ourselves. Like the American soldier, we have the air of plenty, a sense of ease with ourselves and the world, a fund of good nature and a touch of self conciousness and modesty that is rarely absent.

And, we are not without our quarrels. They are our veritable battle fields and in these we show much of the canine in us; two dogs bark at each other, and the rest bark at them.

And for all these little frolics, we are abhorred and looked down upon with scepticism. Others are ignorant of the fact that ever since the time we acquired a sense to trace the inspired alphabet on a broken slate or sand, we have been attending school year in and year out for over two decades and from this hard drudgery at the desks, our fangled nerves and over-wrought brains, need we no escapade?

M. R. M. Punja, B. Sc. Class III.

Conundrums, Ancient and Modern

(For Officers only).

1. Who is the *sweetest* person in India?

   Rao Bahadur T. S. Venkataraman, Sugar-cane Expert, because he gives us the *sweetest* canes.

2. Who is the biggest murderer in Coimbatore?

   Mr. M. C. Cherian, the Entomologist, because he causes *death* to millions............of insects.

3. Who is the biggest liar in Coimbatore?

   Rao Sahib V. Ramanatha Iyer, Cotton Specialist, because he spins the longest *yarns*.

4. Who is the most *ancient* man in the College?

   Mr. H. Shiva Rau, because he has an intimate knowledge of the *Pre-cambrian* period. (Geology).

5. Who is the most religious man in Coimbatore?

   Rao Bahadur G. N. Rangaswami Iyengar, because he always keeps thinking of "*Sorghum*".

6. Who is the Specialist who thinks that *this College* belongs to him?

   Mr. K. M. Thomas because he is the *My-Collegist* (Mycologist).

7. Who is the strictest *disciplinarian* in the College?

   Mr. C. Ramaswamy for he punishes, every ....ball.

8. Why is Mr. R. C. Broadfoot the *Principal*?

   Because he takes a good deal of *interest*. (in the students)

9. Who is the biggest *glutton* in Coimbatore?

   Mr. C. R. Sreenivasa Iyengar, Paddy Specialist because he always thinks of his *Rice*.

10. Who is the most *polite* gentleman in this College?

    Mr. C. Narasimha Iyengar, for he is the *Civil* Engineer.

11. Who is the *brightest* man in the College?

    Mr. M. Kanti Raj, because he is the "King of Brightness."

12. Who is the most *patient* man on earth?

    The gentle reader, who has gone through this article completely!

G. V. Chellappa B. Sc., III

Rev. Henry Ward Beecher's Farm

MR. BEECHER'S farm consists of thirty six acres and is carried on on strict scientific principles. He never puts in any part of a crop without consulting his book. He ploughs, reaps, digs and sows according to the best authorities, and the authorities cost him more than the other farming implements do. As soon as the library is complete, the farm will begin to be a profitable investment.

But book-farming has its draw-backs. On one occasion, when it seemed morally certain that the hay book could not be found, and before it was found it was late,-- the hay was all spoiled. Mr. Beecher raises some of the finest crops of wheat in the country, but the unfavourable difference between the cost of production and its market value, has interfered considerably with its success as a commercial enterprise.

His special weakness is hogs, however. He considers that hogs give the best return for his investments. He buys the original pig for a dollar and a half and feeds him on forty dollars' worth of corn and then sells him for about nine dollars. This is the only crop he ever makes any money on. He loses on the corn, but he makes seven dollars and a half on the hog. He does not mind this because he never expects to make anything on corn anyway. His strawberries would be a great success if the robins would eat turnips, but they won't, and hence the difficulty.

One of Mr. Beecher's most harassing difficulties in farming operations is due to the close resemblance of different sorts of seeds and plants to each other. Two years ago his foresight warned him that there was going to be a great scarcity for water melons, and therefore he put in a crop of seven acres of that fruit. But when they came up they turned out to be pumpkins, and he could not persuade any to buy his pumpkins. Sometimes, a portion of his crop goes into the ground, as the most promising sweet-potatoes and comes up in the form of the most execrable carrots.

When he bought his farm he found one egg in every hen's nest. He said that was just the reason why so many farmers failed—they scattered their forces too much—concentration was the idea. So he gathered those eggs together, and put them all under one experienced hen. That hen roosted over the contract, night and day for many Weeks under Mr. Beecher's personal supervision, but she could not "phase" those eggs. Why? Because they were those shameful porcelain things which are used by modern farmers as "Nest eggs".

Mr. Beecher's farm is a triumph. It would be easier if he worked it on shares with some one. But he cannot find anybody who is willing to stand half the expenses and there are not many that are able. Still persistence, in any cause, is bound to succeed. He was a very inferior farmer when he first began, but a prolonged and unflinching assault upon his agricultural difficulties has had its effect at last, and he is now just rising from affluence to poverty.

S. N. Ramasubramanyan, B. Sc. Class II.

Wise and Otherwise.

The warden wonders why he is never able to see Sumitra Rao and Raghavalu in their rooms. Evidently, sir, you do not go equipped with the microscope and schultze solution.

Ramana Rao tells us that there was IDLI-CONSUMING competition in the Andhra Mess. Well, Rao, who came second?

Punja wants us to fetch a purchaser for his bike. It is quite an easy thing Mr. Club Secretary; there is great demand for scrap iron now-a-days.

K. Narayana Rao asks us why we put on a funeral look whenever he sings. To tell you the truth Mr. Games Secretary, your singing reminds us of a pet-dog that died recently.

T. D. Muthuswami doubts whether he will ever be able to get into the third court. My dear chap, Rome was not built in a day and remember it is not even 3 years since you began Tennis.

Mr. G. N. R. maintains that work should be a pleasure. It is a pleasure which a good many students like to deny themselves.

* * * *

We owe a great deal to Science, says a professor. Having just received the final reminder about electric bill, we agree.

* * * *

" Songs which Veeraghavan sang at Pattambi, haunt us still " says Narayana Reddi. They should, verily he has murdered them.

* * * *

" Read forget, read forget and read ", This is the way to master Chemistry says Mr. H. Shiva Rao. Well Sir, the whole trouble with us, poor students, is that this study-cycle gets broken at the " Forget " point. (U. S. R.)

An Election Reflex.

JULY 20th was the day chosen for the elections. The previous night, need I say, the hostel was bustling with activity. There were canvassings, requests and even threats for votes. One of the candidates gave an extensive, eloquent and forcible election speech at the Hyde Park. All the while I was in my room busy combating with my books and sleep. Naturally the latter got the upper hand and there I was sleeping with my light on.

I don't know when exactly I woke up—but the moment I did so, I heard the election speech. When it was over there was one thing which was ringing in my ears—the election promises. The candidate was trying his utmost to make out that he would do this and that. He added that all this was not mere talk, and the voters would realise the validity of his statements immediately he was declared elected.

I promised my vote to every one that approached me for it. I well know that it was the best means of enjoying sumptuous teas that will be given by successful candidates. How can any one know who exactly got my vote when it is a secret ballot ? What with a dashing game of Ring Tennis in the evening, and to add to it, witnessing a Chess match, I was thoroughly exhausted. In addition I had listened to the Radio.

All these made me fall sound asleep. Sound ? I think I am wrong. A sleep interposed with dreams can never be called sound. Do you deem Eddie Cantor's Sleep in 'Ali Baba goes to Town,' a sound one ? I know you don't. Leaving this alone, I should like to narrate to you my dream :

There were three candidates standing for election. One of them withdrew from the contest on the day prior to the elections. The seat contested for was for the Wardenship ! Are you taken aback ? This is democracy at its best. The Warden for a professional College to be elected by the students from among the students—ultra modern ! H. G. Wells in spite of himself has not foreshadowed this in his " Things to come ". I am sorry to have withheld the news that I was one of the two remaining candidates. My rival began his speech first and was up for full 60 minutes. The effect was really very great. Every moment the audience was becoming thin and actually when I was to make my speech I had a handful to address. Consequently mine was an easy job. I give my speech below :—

'I am addressing you directly and in a very familiar tone. I promise you to be your guide, poet, artist, philosopher and what not, the moment you elect me. You will exercise your prudence and vote for the really deserving. The following shall be my election

manifesto:—My first reform will be the construction of more bath rooms and latrines. I need not tell you how much we are in need of these, (cheers). Secondly. I will see that you are allowed to go on cycles at least to the wet lands (more cheers). Thirdly, to give an innovation to the monotony of Scientific subjects I will make arrangements to see some literary subjects are introduced. After very great consideration I have come to the conclusion that the introduction of English Music and Indian Dance will greatly amuse you. These are but a few of the good many things that I mean doing during my regime. I thank you gentlemen for your patient hearing and I conclude my speech with an appeal for your votes.'

I had some tense moments before the election results were announced. But when they were, what joy was there at my heart to see my name put against the Wardenship I had won by a margin of 13 votes. Is this number the so called unlucky number of the many, my lucky number!

There was profuse garlanding and profound congratulations. Why, there was a pompous procession round the hostel and round the maidan. I thanked them for having chosen me as their rightful guardian. There were clappings.

Clappings—I am sorry—tappings at my door. Then did I know that my neighbour was knocking at my door to take me to the elections. What a dream. I went in haste and excercised my vote. But to whomsoever I gave it, he did not succeed.

C. S. Krishnamurty, B. Sc. Class III.

The Mystery of the Crimson Trail.

(Boys below 19 are warned against reading this story. Those doing so do it at their own risk, The editor cannot be held responsible for any calamity to the weak hearted on reading this story--Ed.)

It was on the 18th of January 1926 just outside Secunderabad that this incident took place, and it was the greatest adventure I had ever had.

If I am not mistaken, I think I was in the I Form. I was young and innocent those days, though my teachers and my parents thought otherwise.

I had just then entered the stage of reading detective stories and very soon, detective novels became an obsession with me. I would read all such novels I could lay my hands on. Money given to me for buying pencils, rubber and note books by my dad, went towards buying two-penny Sexton Blake series. There were only two places where I could read these peacefully. One was the bath-room, and the other, the Tamil Pandit's class. It soon came to be known that I wasn't actually using a lot of rubber and pencils and note books as all that. But I know that I was still crazy about detective stories because I haven't forgotten the terrific kick I received on my pants for stealing the school bully's novel.

I was a particularly happy lad that month because I was the proud owner of a brand new hockey stick that my father presented me with for X'mas. Besides enabling me to play hockey, it was useful to me as a weapon of defence againt my younger brothers and I was happier still about it.

My old man was reading a book on "How to bring up children" in spite of his experience. It said, "encourage your little son to play games. That will keep him away from detective novels". That is why he bought that wonderful hockey stick for me. A pity, I did not know this malicious motive of his.

I think the old man was very clever, because I actually forgot Sexton Blake and played hockey during school hours and other hours, in the kitchen and in the office room.

Being school time, on the 18th January 1926, I did not play in the kitchen, but on a maidan not far away from home and just outside the town limits. This was a lovely, lonely place, a perfect rendezvous for all my friends who were also of similar inclinations. I heard the other day that they are also at present reading that very book which my dad used to read when I was young and innocent—"How to bring up children" by Dr. Hopkins, Consulting Psychologist, California.

Having played hockey almost the whole day without any half time, I was tired by about 5-30 and was returning slowly to be at home before street lighting time, at which time my father reads the muster register for all his children.

I had gone 65 yards or rather 66 yards to be more accurate, when Ismail shouted out "Come and look at this blood here". Sure enough it was blood and sure enough I forgot about that roll call at home at lighting time.

I was a keen scout and a keener amateur detective. The sight of blood immediately fascinated me. All my detective craze was trying to express itself.

Like a true detective I cleared the area and took stock of the circumstantial evidence—a trail of fresh blood between a pair of iron wheel tracks near an unused well.

"Perhaps an unhappy traveller was robbed by a bandit, beaten, put in a cart and dumped into that well. What agony the poor fellow must have undergone" I said to myself. "Perhaps the man's life is still lingering. Why not try to save the unhappy wretch? The scout Association might present me with a medal for it and the police will give me a reward for information leading to the arrest of a notorious criminal for murder".

My friends also were eager to solve the mystery because they were also keen about the medal and the reward.

Strangely enough, the trail did not lead us to the un-used well as we had surmised. So we divided up into two squads, one squad following the blood drops in one direction and the other in the opposite direction.

We were all tired with walking, the light was fading, our hunger ever increasing. We were beginning to despair. The trail at last led us into a big building with zinc sheet roof and a big sign board outside. Over the house a large number of crows and vultures were hovering. "Here lives the murderer" I said to myself. Immediately I wanted to take down the name of the occupant to report to the police. On the board was written "The Corporation Slaughter House'. Nearby stood the cart, I was looking for, smeared with blood. I wished that some one would drop bombs on this building. We were an unhappy lot returning home late that night disappointed, disillusioned and tired. My friends and I thought of murdering Ismail for showing us the blood of slaughtered animals.

The next day we went to school to compare notes with the other squad who had gone in the opposite direction. They had the same experience as ourselves, in a different building. But on the board they read "The Corporation Blood Manure Factory". On return that night they too had met their angry fathers and sympathising mothers.

It is fourteen years since this happened. But believe me it has had a very salutory effect on me. I hate scouting now; I never play hockey though I still enjoy watching it, and I hate nothing more than reading detective stories.

G. V. Chellappa, B. Sc., Class III

On Snoring

AFTER pondering for three days I come to the conclusion that after all snorers are the best enjoyers of sleep. 'I snored away the whole day' that is what one says when one means that one had a very enjoyable sleep, on say a holiday. Look at the snorer as he makes that rythmic *gur gur* sound, his hands, and legs stretched wide apart, his mouth agape and his plump little belly making what is commonly known as a simple harmonic motion. How careful he looks—his relaxed expression suggesting an exquisite pleasure within and a quiet serenity without. But look at this sleeper, his limbs close together and his eyes held tight giving out the very suggestion of 'Disturb me not or else I will be offended.' Last year, in our Hostel, there was one poor chap Shesha by name whose habit it was to sleep very early. But unfortunately for him he didn't belong to the class of snorers. So his friends argued that he really was'nt asleep and that he was only feigning. No sooner did Shesha sleep than a piece of poetry escaped every mouth, "Early to bed and early to rise makes Shesha a happy, healthy and contended chap." Poor man. If only he had been a snorer!

Snorers, I said, are the best enjoyers of sleep at least for the simple reason that sometimes they happen to rob that very same delight from others. Last summer there turned up in our house a gentleman, who, I want you to understand was to us a guest of no mean importance. Of course he was received with much eagerness and when bed time arrived he said 'Not particular about anything like bedding but just some breeze (moving air) is all I want'. So my room was pitched upon and I was to take the guest. He stretched himself on a little carpet near the window and for half a dozen times or so exclaimed 'How hot it is!' Then he drifted into a long talk, for, snorers, as I know them, are nine out of ten, terrible talkers. He talked and talked and did not mind much whether I was listening or not. I was feeling very drowsy and the last question I remember his asking me or rather himself was, why we cannot consider Mr. Gandhi to be a Muhammadan. He paused here expecting me to enlighten him on this point. But a suitable answer being difficult to be imagined I pretended that I was fast asleep soon after and began to dream terrible dreams. A hundred dogs were snarling at each other and pulling each others' tails. I woke up and to my great relief found that all this snarling was nothing but the snoring of my guest at the top of his breath. He was making a variety of noises-at one time comparable to the snarling of a dog and then suddenly changing to the roaring of an automobile. For sometime I listened with deep interest and then closed my eyes. But I could not get a wink of sleep although I rolled listlessly for three hours and more. I tried myself to fancy

that all this noise was ony melodious music and that I was being sung to sleep by a mysterious singer. But my imagination was too poor to swallow anything of this kind. Again I tried to think that I was travelling in a train but with little avail. I blocked my ears with my hands but this only served to amplify the loudness of the noise. The clock struck four. I jumped up from my bed and went out realising that here was an opportunity for me to see the Sun rise.

P. Ananthakrishna Rao, B. Sc., Class I.

Is it a Fact?

That at Cape Camorin Janab Md. Sulaiman began comparing and contrasting the boisterous seas of the other places with the calm one at the Cape.

That when he was at the height of his oration, that the cat was let out of the bag by Mr. Chettiar giving out the fact that the learned orator, was just seeing the sea for the first time in his life.

* * * *

That Punja was seen practising some Bharat Natyam poses in his room.

That it later came to be known, that he was not practising any dance poses, but that somebody had just trampled on his wounded foot.

* * * *

That under the able guidance of Meenakshisundaram, Santhana-Raman reared a millipede for two months taking it for a catterpillar.

* * * *

That during the debate of the 26th October '39, many students had gone well prepared to make " extempore speeches."

That the President did not give them an opportunity to speak and that one of them was so disappointed as to be murderously inclined the whole day.

* * * *

That some of the speakers took it into their head that the meeting was a 'Pugilist display' and that the President was in constant dread of having her spectacles knocked out by one of the speakers.

* * * *

That the residents of the orphanage (15th Block) have approached the Warden for the provision of a lavatory for the Block and that a bore-hole is likely to be sanctioned and that Mr. S. of class II has been deputed to the boring.

* * * *

That Mr. Kantiraj mistook Mr. Upadyayalu's hand-writing for a "seismographic record."

* * * *

That a tour-programme for the II years, has been drawn up and that the chief places included are

Marudamalais--Hill station.
Pujaripalayam—Chola village etc.

*　*　*　*

That the Club Secretary is intending to subscribe for a special copy of the "HINDU" for R. Shetty so that the other members of the Club may have a chance of seeing the paper.

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That the Tennis representative R. Veeraraghavan intends using tennis nets made of coconut fibre as an expression of his insular patriotism.

*　*　*　*

That Sreshta is going to deliver a lecture on "punctuality" and that G. Raghavalu has kindly consented to preside and that the students have been asked to be in time for the meeting.

*　*　*　*

That the construction of the new club buildings is going on vigorously unseen by others, with a view to avoid the 'evil eye'.

*　*　*　*

That Maduram collects film posters as a compensation for not attending any cinema theatres.

*　*　*　*

That K. S. Suryanarayana fell on a girl while going to cinema on Ramalingam's cycle ?

*　*　*　*

That C. Sankara Rao sings beautifully when all go to seelp ?

*　*　*　*

That H. Gurubassapa mistook Nageswara Rao's leg to a cholam plant and cut his leg while harvesting cholam ?

*　*　*　*

That Jagannadha Rao toilettes only four times a day ?

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That K. V. S. Suryanarayana Murthy left playing tennis from the time he was defeated by George Madhuram ?

Editorial Comments.

(By the Tatler Editor)

Saturday Classes.

The introduction of Saturday classes has evoked the greatest concern in student circles. Of course it could not have been otherwise. Saturday, was the best day of the week, both to the Bohemian and the studious among the student community, and this encroachment on the well-earned week-end holiday has robbed both categories of students of their happiest day. We do not mean to say that a student of Agriculture is over-worked, but we dare not say that he gets adequate rest, especially after this new introduction. The Sunday passes off in a trice and we wonder whether the student will ever be able to attend the Monday classes, as much refreshed as he used to be previously.

To the studious man it means the complete negation of the library facilities in the Research Institute. Saturday was the only day when one could hope to go to the Research Library and read one's quota of extra books. View it, as we may, from whatever angle, this innovation completely baffles us as regards its utility. No wonder, the students are not jubilant over the Saturday classes.

The Editor Replies.

R. Shetty :— Sir,

On the 4th Nov. some of the students of our college were called for an interview by our Principal. Has this interview anything in common with the Viceregal interview ?

Editor :— No. It has absolutely nothing to do with it. The students were called just to consider, how best to meet the impending Dec. exam-crisis.

Anonymous Class I — I hear that Mr. Ananthakrishna Rao is a very slow eater. How much time does he take to eat his Mid-day meal ?

Editor :— Well, Sir, I can't tell you the exact time he takes. Anyway if you are so inquisitive and have enough patience, you had better go to the Malabar Mess at 11-30 A. M. and observe. But don't forget to bring the following things with you.

1. One-up-to-date calendar 1940 to guage time.
2. An easy chair to seat yourself comfortably.
3. Two or three **Edgar Wallace's** Novels to read during the period.
4. One kettle of coffee to keep you awake during the travail of waiting.

* *

R. V. S.:— Sir,

I would like to know whether Mr. G. V. Chellappa was ever a Post-man ?

Editor :— Do you mean to say that every body that wears a Khaki suit has something to do with the Postal Dept.? Don't ask silly questions.

* * *

T. K. Rao :— Will you kindly let me know the date on which Mr. Sulaiman was elected as class rep.

Editor :— Was he elected at all ?

* * *

Dindigul Wala : Why did Mr. K. S. Ramaswami resign the post of the General Mess Representativeship ?

Editor :— Are you aware of the resignation of Mr. C. R. ? This might be a case of sympathetic resignation.

* * *

E. V. J. :— When I think of the future of the B. Sc. (Ag.)s I become despondent.

Editor :— There is absolutely no reason for such a despondency. A scheme is already pending with the I. C. A. R. to start a colony of Agricultural graduates in Sahara.

* * *

G. V. C. :— What is the mother-tongue of Mr. Veeraraghavan?

Editor :— It is a problem that has defied many an expert linguist. When he speaks Malayalam, Malayalees take it for Tamil ; Tamilians think it is Malayalam.

A. R :— Mr. Reddiar of Class I says that he has read Shakespeare's 'Sherlock Holmes' series. Have you also read it ?

Editor :— I haven't. But, any way, ask Mr. Reddiar whether he has read "Scot's Emulsion" also.

* * *

Gokhale :— Why is Mr. G. V. Chellappa still in the 4th Court ?

Editor :— Because there is no 5th Court.

Thiagaram :— We are feeling much handicapped by not being allowed to go on bykes to College. Suggest something instead that would not go against the rules.

Editor :— "The Hindu" has advertised that there are some elephants for sale. Why not you buy one ?

Mahimi Dass :— When is the Hockey field getting ready ?

Editor :— At the rate at which the repairs are going on, it will be ready by August 19th 1959 at 2-30 in the afternoon according to our fastidious mathematician.

Students' Annual Club Day Celebrations.

The Annual Club Day was celebrated on Saturday the 24th of February 1940 with great interest and enthusiasm. It was a day of triumph, merriment and unalloyed happiness to one and all the students. The sports and tournaments connected with it were concluded prior to the Club day. The happy function commenced with 'Tea' at 4 P. M. as usual. The fancy dress competition provided great amusement to the visitors. After 'Tea' the guests and the students adjourned to the tastefully decorated Freeman Hall, where a meeting was held with Sri. N. Chandrashekara Ayyar, B. A., B. L., District and Sessions Judge, Salem in the chair. Student P. Paramananda Panda is to be congratulated for the simple, exquisite and artistic way in which he decorated the hall.

After reading of the reports of literary and games Sections for the year 1939-40, by the respective secretaries, prizes were distributed by the President to successful candidates. This was followed by a variety Entertainment which included the following interesting items, which were greatly appreciated.

1. The opening chorus. (2) The college Rag. (3) Instrumental music. (4) "Examinership conferred" A farce in English. (5) Magic and feats of strength. (6) Indian songs and (7) A scene from S. Kanara field drama.

The pleasant function terminated with the presidential address followed by a vote of thanks by Mr. R. C. Broadfoot, Principal of the College.

The following is the list of prize winners in various events held in connection with the Club day.

Indoor games.

	Winner.	*Runner up.*
Table Tennis singles.	K. Narayana Rao.	D. Narasimhamurthy.
„ „ doubles.	R. Veeraraghavan & Satyanadhan.	Sommanna & Narayana Rao.
Carrom Singles.	K. Narayana Rao	Monappa Hegde.
„ doubles.	S. V. Srinivasan & Panda.	K. V. S. N. Murthy & Narayana Rao
Chess.	B. S. Krishnan	A. G. Kesava Reddy.
Draughts.	Noel Sreshta	M. Ramiah.
Blow Ball	Kovlutlayyas' team.	

Sports.

Tennikoit singles.	Ramakanta Reddy	Md. Sulaiman.
„ doubles.	Ramakanta Reddy & Sanyasi Rao	B. L. Gunapragasam & Md. Sulaiman.
Volley Ball (6)	Ramiah's team.	
Volley Ball (9)	Veeraraghavan's team.	
Badminton doubles	R. Veeraraghavan & P. Venkateswara Rao.	B. Padmanabha Raju & A. Subba Raju.
„ Fives	R. Veeraraghavan's team.	
Tennis singles.	R. Veeraraghavan	M. R. Mohan Punja.
doubles.	R. Veeraraghavan & K. Bhakaram.	Chintamani & Narayana Rao.

Ringing the stump :— 1. Md. Ibrahim 2 Fazlullah Khan.
3 legged race :— 1. Daniel Sunder Rajan & Satyanadhan 2. Narasimhamurthy and Hanumantha Rao.
Bowling at the stumps :— 1. S. V. Srinivasan. 2. G. H. Madhuram.
Kicking the foot Ball :— 1. George, C. M. 2. Kamalakaran.
Scooping the hockey Ball :— 1. S. V. Srinivasan, 2. S. N. Ramasubramanian.
Tailing the elephant :— 1. V. C. Upadhyayulu. 2. Sivasubramanian,
Musical chair on cycles :— 1. Md, Baig, 2. Noel Sreshta.
Running back :— Mohan Punja, 2. Keshava Reddy.
Slow cycle race :— 1. Rama Mohan Rao. 2, Azariah.

Inter tutorial competitions :—

Krishnamurthy Rao Memorial Hockey cup :— Sri. C. R. Srinivasa Ayyangar's Wards.
Rao Sahib V. Muthuswami Iyer's Foot Ball shield — Sri. C. Narasimha Ayyangar's wards,
Rao Bahadur C. Tadulingam Mudaliar Cricket Cup— Sri. C. R. Srinivasa Ayyangar's Wards.
C. Ramaswami Elocution Cup—Sri. C. N. Narasimha Ayyangar's Wards.

Inter class matches:—

Parnel Cup	Class III
Victory Cup	Class II.

Literary competition :—Essay writing:— 1. K. Narayana Rao, 2. Seshavtharam. G. V. Chellapa.

Elocution competition :— 1. Md. Baig, 2. Gurubasapa, 3. C. Upadhyayulu.

Colours were awarded to :— Tennis :—nil. Hocky-Daniel Sundera Raj. 2. Azariah, 3 Mohan Punja. Foot-Ball— 1. Ramakanta Reddy, 2. Gnanapragasam. Cricket :— 1. K. M. Somanna. 1. Athletics. 1. M. R. Mohan Punja, 2. R. Veeraraghavan.

The Parlakimidi Cup:— Awarded to the all round sportsman of the year— R. Veeraraghavan.

Special cup for the best student artist— P. Paramananda Panda.

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(ORGAN OF THE M. A. S. UNION)

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EDITORIAL

The late Raja Sir Vasudeva Raja of Kollengode. We regret to record the death of one of the Patrons of the Madras Agricultural Students' Union, Raja Sir Vasudeva Raja of Kollengode at Bombay on April 7. Born on October 8, 1873 and educated in the Victoria College, Palghat, the Raja Saheb belonged to a very ancient and artistocratic family of landowners in Malabar, of which he was the senior member. Of a religious and charitable disposition, the Raja was connected with several educational and social institutions and either maintained or endowed many schools and hospitals. He was a fellow of the Madras University and was a member of the Madras Legislative Council from 1906 to 1912. In 1930, he was returned to the Central Assembly by the landholders of the Madras Presidency. He evinced a keen interest in agriculture and agricultural problems of the country and gave valuable evidence before the Royal Commission on Agriculture in India. We offer our condolences to the bereaved family.

Service conditions in the Imperial Council of Agricultural Research. it is now eleven years since the tmperial Council of Agricultural Research has been inaugurated and quite a large scientific staff is at present in the employment of this organisation. Several of these are officers borrowed from the services of the Agrıcultural, Live Stock and other departments of the constituent Provinces and States and who hold a lien on their permanent posts, but a considerable number is recruited directly to the services of the Council. It is in the very nature of the schemes financed by the Council that they are to run for short periods only, and as such, the employees cannot hope for a security of tenure comparable to what is obtainable in the Government services. It has however to be borne in mind that the scientist like every other human being can be happy, contented and efficient only when his future is not threatened with the nightmare of unemployment. Now that the Council's financial resources are established on a sound footing, it is our opinion that the Council should set its mind to devise ways and means to offer to its employees that much needed security of tenure, so essential for efficiency and contentment among their ranks. Instances have come to our notice where ex-employees of the I. C. A. R in some parts of the country have been left

to drift into the ranks of the unemployed after several years of useful service merely because this or that scheme of research has been closed down. The valuable knowledge and experience of these scientists are in danger of being lost to the country and their experiences dissuade the right type of men from offering themselves for future recruitment. We consider that it should not be difficult for an extensive organisation like the Imperial Council of Agricultural Research to devise a system, by virtue of which, experienced and efficient men thrown out of employment by the closure of one scheme can find employment in another scheme elsewhere, and we trust that this matter will receive the attention it deserves at the hands of the Council.

Notes on some spice crops

By M. CHINNASWAMI NAIDU, L. Ag.,
Agricultural Demonstrator, Udumalpet.

Introduction. Spices and condiments like chillies, onions, garlic, turmeric, are useful to man to add flavour and taste to his food. Their use in food generally helps to stimulate the digestive organs. They serve as medicines or medical adjuncts. As a drench or as a tonic powder they are largely used for live-stock. It is not the purpose of this article to discuss the effect of the several spices as medicines. Spices being very useful to man in some form or other in daily life, the cultivation of three special spice crops viz. cummin, coriander and garlic is discussed in the following pages. These are not commonly cultivated all over the country because they can be grown only under certain favourable conditions of weather, soil and water supply. Also their cultivation is of a special nature. Now and then, several enquiries are received from ryots of various parts about the cultivation of these crops. Therefore, the information on certain aspects of their cultivation as practised in the Udumalpet taluk of Coimbatore District is detailed for the benefit of those who desire to cultivate them. As conditions favouring their cultivation are restricted, the profits which may be expected by the successful growing of such crops of almost universal use are certainly more than what may be got from the ordinary crops. The knowledge on the cultivation of these crops are therefore of much importance to the ryots.

I. Cummin.

(Botanical name—*Cuminum cyminum*)

Tamil	*Siragam.*
Telugu	*Jilakara.*

Cummin is cultivated over limited areas in parts of Coimbatore, Cuddapah and Kurnool. This does not come under scheduled crops and therefore the area under cummin in Madras is not known. It is a very delicate crop which requires much care from the preparation of seed bed to harvesting, threshing and bagging. A salubrious fine weather with mild sun and light drizzle as is available in parts of Pollachi and Udumalpet taluqs of Coimbatore District during the South West Monsoon season is essential throughout the progress of the crop. The success or failure of the crop is very much dependent on the season, especially at the time of flowering.

Season and weather conditions:— In Udumalpet taluk where cummin cultivation has been going on for a long time but over a very small area annually, the crop is sown at about the end of May (*Vaigasi* 15th) just in the season when the south-west monsoon is about to commence. The weather which is then mild and cool due to the light showers accompanied by a gentle breeze is conducive for the healthy growth of the crop. If the weather is otherwise and the atmosphere stuffy with moist heat and the sun

very bright and hot, the crop withers and the flowers shed, resulting in failure. There is also another season for the crop, i. e. *Margali-Thai* (about January) But the crop grown in this season is often affected by dew and mist which are harmful to the healthy growth of this crop. So this is a delicate crop which is very much dependent upon the vagaries of the season in which it is grown.

Soil and its preparation:— Rich red-loams and garden soils of a well-drained nature are best suited for the crop. Land for sowing must be very clean. Stubbles of the previous crop, pebbles and stones must be removed. A fine tilth and a firm seed-bed should be obtained. No direct manuring is done to the crop. *Cumbu* (Pearl millet) which generally precedes cummin should be heavily manured with well-rotten cattle manure or by penning sheep at 5000 per acre. The land becomes fit for cummin after a crop of cumbu during which the manure gets well-rotten and easily available. The weeds are got rid of and the soil becomes cool and friable. After harvesting cumbu, the stubbles should be removed which is ordinarily done with a mammatty. Otherwise, a light ploughing and breaking up of clods may be necessary before sowing cummin. The land should be absolutely free from weeds, especially *korai* (nutgrass) which is very difficult to weed out from the cummin crop. Sowing is done in beds which are long and narrow, 4 feet wide, 8 feet to 10 feet long to facilitate weeding of the entire plot by the women working from bunds only.

Seeds and sowing:— Seed cummin is different from the ordinary cummin sold in the bazaar. The seed cummin is a selected grain well dried and preserved. It is more costly than the bazar produce. The seed rate is about 1 to $1\frac{1}{2}$ maunds per acre (a maund = 25 lbs). The cost of cummin seed varies from Rs. 5 to Rs. 10 per maund. One man and 4 women can sow an acre and cover the seeds. After sowing the seed, beds are stirred carefully with a stick about two feet long and forked at the end to cover the seeds. Otherwise seeds may be buried too deep.

Irrigation:—The first two waterings must be very carefully done as otherwise there may be failure of germination by the seeds being covered with too much earth or being carried to one corner of the bed, floating on the surface. The crop requires to be irrigated once in three or four days. The total number of irrigations may come to 15 to 20 in 60 days which is the duration of the crop from sowing to harvest. A well fitted with two mhotes, may command 3 acres under this crop, if the water is not diverted for other crops.

After cultivation:— Weeding commences after the third watering i. e., the tenth or twelfth day after sowing. The tools used are small, 6" to 8" long with a sharp end and not of any special nature. Even small iron spoons are used for the work. Weeding is done by women working from the bunds, one from either side, the width of the bed being only 4 feet. Two women thus move together from bed to bed. Eight to ten women

manage to weed and hoe an acre and more labour is required if the field is very weedy. The total number of hoeings needed is three to four at intervals of 5 days to a week. Weeding and hoeing are done till the crop spreads itself out to shade the soil.

Forty days after sowing flowering commences. The crop is then 6″ to 9″ high. At this stage in spite of all care taken by the cultivator in the cultivation of the crop, if weather conditions are adverse, fruit setting will be poor. The ideal conditions of good breeze, mild sun and light drizzle will be congenial and will bring the crop to fruition. Excess of heat, stuffy atmosphere, want of breeze and heavy down-pour of rain are all injurious to the crop at this stage. No seed will set under the latter conditions.

Harvesting and threshing. Sixty days after sowing, the crop is ready for harvest. Then the plants are carefully pulled out with their roots, and placed in a blanket and bundled. The harvested crop is taken to the threshing floor, which should be very clean, hard and protected from wind. It is allowed to dry there for two days. Thin canes are used in threshing out the seed which is done by tender beatings. Small quantities from the heap are taken and beaten at a time, until the whole lot is finished.

Cleaning. The cummin and the dry broken stalks which get mixed up at the time of threshing are separated by winnowing in a light breeze or with a hand winnower.

Economics. The best yield obtained per acre is 50 maunds or 10 bags, the average being only 30 maunds. Some years back, a maund of seed was selling at Rs. 4 to Rs. 15 per maund. The cost of cultivation is about Rs. 50 per acre while the net income varies from Rs. 100 to Rs. 300 depending upon the yield and the demand for the seed. From Udamalpet it is exported to Madras, Calicut and other places. But when the supply of cummin falls short, the local demand is met from Bombay. The price of cummin has fallen now to Rs. 3 to Rs. 4 per maund.

Pests and diseases. The crop is attacked by 'mildew' (Kolli novu) which is caused by a fungus (oldiopsis taurice) When plants are affected by this, they become black and dry up. It is also subjected to some root-worm attack. This causes withering of plants.

Of recent years, owing to the very delicate nature of the crop and unfavourable season, the cultivation of the crop is limited to only small patches in this taluq. It is therefore as precarious a crop as it is valuable.

GARLIC

Botanical name	= *Allium sativum.*
Tamil ,,	= *Vellaipoondu.*
Telugu ,,	= *Tellagadda.*

In Udamalpet taluk, garlic is known as a rare field crop. As a food, garlic is almost universally used in curries on account of its varied medicinal properties. Though it is allied to ordinary onions, it is a more valuable crop than onion and keeps much longer. It is also more costly. In this

taluk, it is cultivated side by side with ordinary onions almost under similar conditions of soil and water supply. Therefore, garlic crop as a rule, is cultivated by every ryot who grows onion in his garden lands which are not suited to the raising of the tobacco crop. In other words, it may be said that garlic suits the sweet water conditions well.

There are two seasons *(pattams)* for the crop in Udamalpet :—

1. June to September—*Vaigasi pattam* or *kar pattam*.

2. November to March—*Karthikai* or *Parvam pattam*. The duration of the *kar* or summer crop is 105 days while that of *paravam* or winter crop is only 90 to 95 days. It is raised from bulbs. The seed rate per acre is 8 to 10 maunds (1 maund = 26 lbs.) the lesser seed rate being for winter crop. The seed from the *kar pattam* is used for sowing in *parvam pattam* and vice versa. Keeping the seed beyond one season is uneconomic.

Soil. Good black-loam is best suited for the crop. It is however grown in red-soils also. The crop does well after ragi. It is, however, not uncommon to plant them in fallow fields kept well-ploughed for some time.

Manuring. The manuring aspect of the crop is an important one and it should be properly attended to. Being a 'root-crop', the field to be planted requires a heavy application of manure. The ryots apply to the crop about 40 to 50 cart-loads of cattle manure besides sheep penning up to 6000 sheep per acre. Application of potash manures in addition to vegetable composts would be beneficial. Municipal rubbish and house-sweepings contain potash and may be applied with advantage.

Sowing. Sowing is done with the hand after beds are formed; the size of beds depends on local practice. The whole bulbs are separated into segments by rolling them on a hard floor. After sowing they are covered lightly with soil and then irrigated. A day or two later, the bulbs that are exposed are gently pressed down with the fingers into the soft earth. Twenty to thirty waterings are necessary at intervals of 3 to 5 days and four weedings, within two months.

Harvesting and Preparation for the market. Harvesting is done when flowering commences. The proper time for harvest is ascertained by removing a few plants at random from some of the beds (after the 90th day from sowing). When three '*porais*' (separate bulbs that project like knobs from the surface of the entire bulb) are formed in, say, 6 out of 10, the crop may be considered to be ready for harvest. Harvesting is done by levering up the entire plant with a small iron stick termed '*ambu*'. The stuff, after harvest, is left in the field for 1 or 2 days to dry with the leaf. If the crop is very good, the leaf may be cut then and there. Later, it is brought to the drying floor where it is dried in the sun till the green leaves completely dry up. The bulbs harvested at the right time, should be hard and white. If the harvest is delayed, a pinkish tinge may develop on the surface of the bulb. This reduces the market value of the produce, hence the importance of timely harvest. When the bulb is well dried for 4 or 5 days in the

sun, it is kept spread out over-night. The next day, the produce is bagged in lots of 5 maunds each and is then ready for the market.

The yield obtained per acre varies with the season, the treatments given and the health of the crop. The crop being one of a delicate nature is subject to the attack of insects like thrips and fungus diseases like *Alternaria palundii*.

Twenty to twenty two fold (20-22 maunds from a maund of seed) is considered a good yield. 10 to 15 maunds for one maund of seed is regarded as a medium crop and 7 to 10 maunds is considered poor. The crop used to fetch Rs. 5 to 6 per maund though the present price is as low as Rs. 2 to Rs. 3 per maund. The price varies according to the size and quality of the bulb.

Garlic is despatched to outside districts. It goes to Trichinopoly, Tanjore, Palghat, Ernakulam, Cochin, Nilgiris, Madras, Dindigul, Madura, South Arcot and Guntur. From some of these places it is exported to Ceylon.

Given good tilth, sufficient manure and frequent irrigations, a good crop is usually obtained. Clear bright weather during the growing period is very desirable.

It is interesting to note that garlic that is produced in Udamalpet taluk is not used locally as it is of a very pungent quality. It is said that the local garlic is suited only to places hotter than Udamalpet. Annually about 5000 maunds (1 maund = 26 lbs) are exported to out-side districts. The ruling price is Rs. 2 – 4 – 0 per maund of 26 lbs. For local consumption, hill garlic (*malai poondu*) from the Travancore High Ranges and Kodaikanal hills is imported. About 300 to 400 maunds are consumed in Udamalpet annually. The hill garlic is a mild one as compared with the local one and it is said that it is favoured in places like Udamalpet. The price of hill garlic is always Rs. 1—0—0 to Rs. 1—8—0 more per maund than the local garlic. The present price of hill garlic is from Rs. 3—0—0 to 3—8—0 per maund of 26 lbs.

Onion is a serious competitor for the garlic crop. The area under this crop is generally regulated by the price of the onion crop. Fungoid diseases also seriously affect the crop. The present low price is also standing in the way of extension under the crop.

The cost of cultivation and the profits per acre from the crop are roughly as follows:—

Cultivation Details.

		Rs.	As.	Ps.
Ploughings 5 @ Re. 1—4—0 per ploughing	...	6	4	0
Forming beds (4 men)	...	1	0	0
Seed: 10 maunds	...	30	0	0
Sowing: 10 women	...	1	4	0
Watering 32 at 3 Rs. per irrigation.	...	96	0	0
Sheep penning (6000)	...	15	0	0

Cart loads of cattle manure or Village sweepings 25	...	25	0	0
Hoeing and weeding: 60 women for 4 hoeings	...	7	8	0
Harvesting	...	1	0	0
Cutting the leaves and cleaning: 20 to 25 women	...	3	0	0
Drying and bagging	...	1	8	0
Total	...	187	8	0
Yield 150 maunds at 2--4--0 per maund of 26 lbs.	...	337	8	0
Expenses	...	187	8	0
Gain per acre	...	150	0	0

The profit is calculated for a crop of normal yield. The crop in Udamalpet taluk is loosing ground due to continuous bad seasons, risky nature due to diseases and insects and low price for garlic.

CORIANDER

Botanical name		*Coriandrum Sativum*
Tamil	,,	*Kottumalli*
Telugu	,,	*Dhanialu*

Coriander seed is much used in South India as a condiment. The plant in its seedling stage is used as a green vegetable to flavour certain dishes. It is grown in Madras presidency to a large extent, on about a lakh of acres a year, chiefly in Tinnevelly and Coimbatore districts. The crop is confined to the black soil. It is mainly grown as a mixed crop with dry cotton. But in deep black cotton soils, it is also cultivated as a pure crop.

Mixture with Cotton. As a mixed crop with cotton, no special cultivation is given to it except what is done for cotton. For cotton, the field is ploughed two to three times in the hot weather between May and September. With the North-east moonsoon in October, a mixture of cotton and coriander is sown broadcast in the ratio of 10 : 1 (i. e. 10 lb of cotton seed and 1 lb of coriander seed per acre) and the seeds are covered by the country plough. It comes up and grows alongside with cotton. Two weedings and hoeings, one in November and another in December are done. Three and a half months after sowing, coriander is ready for harvest. The yield comes handy to the ryot at the time of his first payment of kist.

The cost of cultivation as a mixture crop is not more than a rupee which includes the value of seed sown and the harvesting and threshing charges.

Curing. The crop is harvested early in the morning and is taken to the threshing floor tied up in bundles. The bundles are stacked in such a way that the shoots are towards the centre of the heap and roots are pointing outside. In the stack they undergo fermentation which probably helps the development of aroma and renders threshing easy. On the evening of the second or third day, the stack is disturbed and the bundles are taken out and spread on the threshing floor with heads upwards. They are kept thus exposed over one cold night. Early next morning, teams of cattle are used in threshing. In case of a small crop, treading is done by

human labour. The seed which is mixed up with dry leaves and broken stalks is winnowed and dried before bagging. A bag of well dried seed weighs about 80 lbs measuring 54 Madras measures. In the case of a mixture crop, the yield is about 100 lbs and the net profit per acre is about Rs. 4.

Pure crop. Coriander as a pure crop receives all the operations which were detailed above for a mixture crop of cotton and coriander. The seed rate is, however, more, 10 to 12 lbs. per acre, and also the yield is high— 400 to 500 lbs. per acre. Deducting the cost of cultivation from the value of the produce, the net profit per acre out of a pure crop is about 10 to 15 rupees.

The cotton crop succeeding a pure coriander crop in dry lands is said to grow and to yield well. Therefore it is considered a good crop to rotate with cotton.

Garden land cultivation. In garden lands, coriander is cultivated in June. The land after being ploughed well 4 or 5 times, is manured heavily. Before sowing, clods are broken to obtain fine tilth of soil. Beds measuring 10 feet by 4 feet are then formed and the seed is sown broadcast at 10 to 12 lbs. per acre. After the seed is sown, water is applied gently, from bed to bed. The first irrigation is given 3 days after and subsequent irrigations at the same interval. The seeds germinate in 10 days. The crop is, afterwards, watered once a week till the harvest time.

In the case of an irrigated crop, the cost of cultivation is high on account of the irrigation charges and the cost of manuring, unlike in the case of a dry crop. The yield got from the irrigated crop is about 1500 lbs. The cost of cultivation is about Rs. 25 and the net profit per acre is about Rs. 60. In gardens near towns, the tender coriander leaves, if sold as vegetable, fetch a better profit.

Coriander seed is disposed of by the growers through the commission agents who export the produce to outside districts like Tanjore, Trichinopoly, Tuticorin and Madras. There is a keen demand for the seed in Ceylon where it finds a market. It is exported there from the Tuticorin port. The Indian coriander has to face a strong competition in the Ceylon market, from foreign coriander from Russia and Morocco. Russian coriander often commands a higher price than the Indian produce because merchants in Ceylon consider the foreign product better than the Indian coriander in being clean and of better quality. On examination of the different samples of the coriander seed at the Agricultural Research Institute, Coimbatore, it was found that they contained impurities as shown below :—

Morocco Coriander	1·6	per	cent
Russian ,,	5·2	,,	,,
Tuticorin ,,	20·8	,,	,,
Rangoon ,,	5·8	,,	,,
Coimbatore ,,	1·1	,,	,,

The Coimbatore coriander was the best and it contained less adulteration of stalks and sticks, stones and mud, 1 part only in every 100 of material. It is the Tuticorin coriander that gives our coriander a bad name in the Ceylon market. Russian coriander is considered better in point of flavour. But this is a disputable point, since flavour and smell varies with people and places. But one thing has to be said about the flavour, viz., the freshness of seed. If the seed is stored for a long time, it may turn rancid and may also be attacked by insects.

It is therefore to be said that while the Indian coriander is not in any way inferior in quality to the Russian coriander, the dirty condition in which it is marketed is probably the reason for its having lost favour in the Ceylon market. This defect can be remedied by the grower and vendor by following the hints given below:—

(1) During cultivation, see that all weeds are removed, so that other seeds may not get mixed during harvest.

(2) Harvest carefully, taking care to winnow out stalks, sticks and empty light seeds and seeing that no stones or mud get mixed up.

(3) After cleaning the seed, store carefully in bags and market as soon as possible.

(4) Avoid adulteration of any kind in the hope of making extra weight; if this is done, it will soon be found out and buyers will lose confidence in you and your reputation will be lost.

These rules are simple and easy to follow. The care in cultivation and honesty in marketing are the golden rules of success.

In recent years, owing to high price for the commodity, its cultivation is extending and it is becoming a more prominent subsidiary crop in this presidency.

The crop is subjected to 'Mildew' ('*Sambal Novu*') which appears at the time of flowering. On account of the disease the flowers wither and shed without setting seed. The cloudy and dewy weather in the cold weather months encourages diseases and pests.

Physiological Studies during Vernalization in Rice*

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Introduction. The term vernalization is a comparatively new one and its original equivalent in Russian is *Jarovizotie*. The term signifies (a) a stage of development during the germination of seeds; (b) the process developed by Lyssenko by which the flowering phase of a plant is forced earlier than usual by certain pre-treatments of the seed.

Theory of Vernalization. The main theoretical conceptions on which vernalization is based are (1) growth and development are two independent processes; (2) morphological features are no indication of development; (3) plants have different stages of development.

Growth and development are two independent processes that take place in a plant. The length of the vegetative period is not fixed for a plant. It is determined by a set of external factors though an individual factor can hinder the growth of a plant. Factors determining development are different from those determining growth and they are not antagonistic to each other. The time required by a plant to flower is determined by certain factors whose nature and magnitude are different for different plants. These factors may be allowed to act on germinating seeds or on growing plants. The duration of such stimulants varies in like manner both for the germinating seed and for the green plant. The process of sexual development is determined even in the germinating seed.

Lyssenko mainly recognises five stages of development. The plants follow strict sequence and cannot proceed to the next stage unless the previous stage is completed. Of the five stages only two are completely understood. The first one is "vernalization stage" or "thermo-stage" and the second one is "photo-stage". The third stage, according to Kraevai and Kiricenko (1935) is associated with gametogenesis.

Photoperiodism. Klebs was the first to recognize the fact that the flowering duration in plants is not inherent in them but can be altered. Light is one of the factors. Garner and Allard (1920) divided plants into the following classes. (1) Long-day plants which progress quickly towards maturity under an artificially prolonged day. (2) Short-day plants which progress quickly towards maturity under shortened day. (3) Plants which are indifferent to light period.

On-set of flowering. In addition to the theory of photo-periodism there are two more theories regarding the on-set of flowering—(1) Hormone theory and (2) Carbon-nitrogen ratio theory. Lyssenko refutes the conception that there is antagonism between development and growth of plants. The main

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difference between Lyssenko and others lies in the material used for experiments The former dealt with vernalized seeds and others dealt with green plants. The latter in their attempts to make the plant flower earlier shortened the assimilation period and thus brought about poorer vegetative growth. Lyssenko experimented with vernalized seeds and found that provided the required amount of darkness was given to the vernalized seed, the plant came to flower earlier even in continuous illumination. Lyssenko is of opinion that C : N ratio is only a result of the on-set of flowering and not the cause of it. Since the state of vernalization does not spread from part to part of a plant, the hormone theory does not hold good.

Vernalization in Rice. Ukrainskii (1934) found that the reduction of the length of day to 12 hours accelerated flowering by six days. Hence rice is concluded to be a short day plant. Ossewarde (1935) found that the plants of the two weeks treatment were 2–7 days earlier than the control. Haig (1934) in Ceylon found that the treatment for six to 10 days shortens the duration of rice when compared with dry sown seeds. The reduction in duration is mathematically significant but not economic.

Bio-Chemical studies. Biochemical processes relating to vernalization were studied only in Russia. Demkovsky (1932) found a general increase of enzyme activity and also a change in the inter-relation between different groups of enzymes. He expects to derive an indirect method to determine the stage of seed vernalization by changes in the enzyme complex. Rancan (1933) made a comparative study of the changes in the activities of diastase, protease, peroxidases and catalase, on winter wheat. Catalase showed a double maximum on the twentieth and twentyfifth days and the maxima were followed by a sharp fall. The study of Rubin and Naumova (1934) showed that there was a correlation between the energy of plant development and the action of enzymes, particularly that of catalase.

Material and method. The experiments were conducted on the strain of paddy G. E. B. 24 and four other strains obtained from Coimbatore Paddy Breeding Station. The seeds were sterilised in mercuric chloride solution and soaked in water for 18 to 20 hours. The water was then drained off and the moisture adhering to the seeds removed. They were then placed in dishes and kept in a cool chamber. The temparature of the chamber was maintained between 10° and 20°C. When the seeds appeared dried up, a small quantity of water was sprinkled over them. By careful adjustment of moisture the further growth of the seedling was prevented. One set of seeds was kept in a chamber which was illuminated continuously by a 500 Watt bulb. Another set was kept in a dark chamber. The temperatures of the two chambers did not differ very much. The seeds were subjected to this treatment for three weeks. The individual flowering duration of the plant from these seeds was determined by observation in the field and it was found that the flowering duration of the control was 101 days after transplanting while that of the seeds vernalized in darkness was 96·2 days. The difference though significant is not economic.

Experiments on Diastase and Catalase :— The changes in the quantity of diastase and catalase during the process of vernalization in G. E. B. 24 were followed. Diastase was estimated by pulverising the seeds and preparing 1% water extract. 10 cc. of 1% starch solution buffered at pH 4.6 was added to 10 cc. of the extract and the enzyme action was allowed to proceed for 1 hour in a water bath maintained at 40°C. The reducing sugars formed were estimated by Shaffer and Hartman's micro method. The milligrammes of glucose so formed represent the diastase activity in 10 cc. of the extract or its equivalent of 0·1 gm. of the seeds. From this the total activity in 100 seeds is calculated. The catalase activity was determined by pulverising 25 seeds with $CaCO_3$. This was placed in one arm of Heinicke's tube and in the other 5 cc. of neutralized Merck's H_2O_2 was placed. They were mixed and shaken at the rate of 25 shakings per minute. The quantity of oxygen evolved at the end of 5 minutes was taken as the measure of catalase after being reduced to N. T. P. The total catalase activity for 100 seeds was then calculated.

Diastase :— The diastase present in the seeds during the vernalization process is greater than that in un-germinated seeds. In appearance the vernalized seeds show no difference from the ordinary seeds except for the small crack in the seed coat at the region of the embryo. The diastase present in the seeds that are vernalized in light is greater than the quantity present in the seeds vernalized in darkness. The data are presented below :-

TABLE I. Quantity of diastase in vernalized seeds :—
(Figs. in mgm. of glucose for 100 seeds).

Day of vernalization.	Vernalization in	
	light.	darkness.
3	58·08	67·24
4	183·04	44·00
5	159·44	25·68
6	92·56	23·60
7	114·40	60·88
11	148·20	30·28
24	132·48	—
25	152·76	30·28

The two sets of G. E. B. 24 seeds that were vernalized in light and darkness were then placed for germination in trays after 40 days of the treatment. All seeds germinated and they were analysed for diastase. The data are presented below :—

TABLE II. Quantity of diastase in vernalized seeds when they germinate.

Hours after soaking.	Seeds vernalized in		Control untreated seed.
	light	darkness	
48	197·75	93·85	112·60
72	435·20	408·15	317·52
96	608·70	666·40	636·48
120	913·10	998·60	558·04

The seeds treated in light show a larger diastase content up to the third day; later the seeds treated in darkness show a larger content. The quantity present in the treated seeds are considerably greater than those in the untreated seeds.

Catalase. The sampling of the seeds for determination of catalase was done on the same day as that for diastase determinations, so as to find out the course of change in the two enzymes in relation to each other. The data are presented in the following table:—

TABLE III. Quantity of catalase in vernalized seed:—

Days of vernalization.	Vernalization in	
	light.	darkness.
3	24·58	7·10
4	18·95	7·44
5	20·67	8·13
6	11·84	7 78
7	14·90	11·18
11	10 84	7·45
24	16·20	9·79
25	12·81	9·78
26	11·46	9·44
37	9·16	10·17

It is found that the quantity of catalase in seeds treated in light is very high on the third day, but it slowly falls until on the 37th day it is dwindled to 1/3 the original content. The catalase present in the seeds treated in darkness is almost steady. However, the quantity is less than that in light treatment in the initial stages and the two are almost equal after 37 days of treatment.

The quantities of catalase present in the treated seeds when they germinate were followed. The data are given below:—

TABLE IV. Quantity of catalase present in the vernalized seeds when they germinate.

Hours after soaking	Vernalized in		Control un-treated seeds.
	light.	darkness.	
48	7·61	10 15	36·36
72	39·34	48 64	88·73
96	85·12	95·29	146·38
120	114 62	134·14	180·02

The catalase content of the seeds vernalized in light is less than that of the seeds treated in darkness. The comparison between the catalase content of the vernalized seeds and that of the control is interesting. The quantities of catalase present in the treated seeds are far less than those of the control.

Discussion. The experiments show that the seeds undergoing vernalization treatment contained larger amounts of diastase and catalase than

ungerminated seeds. Control seeds when they germinate on moist blotting-paper grow rapidly and in 48 hours the radicle grows to nearly 0·1 to 0·2 inches length. At this stage of growth the diastase content of 100 seeds is 112·60. The seeds undergoing vernalization treatment have shown more than this quantity of diastase though with regard to growth they have only burst open the seed coat near the embryo and are not growing any further. The diastase content of the seeds vernalized in light is very high and there are daily fluctuations. The diastase content of the seeds vernalized in darkness is far less than that of the light vernalized seeds. When the vernalized seeds were germinated on moist blotting paper after 40 days' treatment the higher diastase content of light vernalized seeds is maintained only up to the third day and later the darkness vernalized seeds take the lead. Both the treatments have effected a greater diastase content throughout the course of germination than that of untreated seeds.

Changes in the quantity of catalase in the vernalized seeds are similar to those of diastase. During vernalization in light the seeds show a very large increase in catalase in the initial stages but it slowly decreases. The seeds that are vernalized in darkness show almost a steady catalase content. When the seeds are kept for germination there is increase in catalase in both the lots. The seeds treated in darkness show slightly a larger amount of catalase than the ones treated in light. Both of them show considerably low contents of catalase as compared to the control. Therefore it may be concluded that while the vernalization treatment causes an increased diastase content in the germinating seeds it impairs the catalase production. The experiments show that the enzyme complex in the seeds undergoes a change during vernalization. The change is seen during the course of the treatment as well as when the seeds germinate after the treatment. A detailed study of the enzyme complex at different stages of vernalization may be useful to determine the degree of vernalization.

Summary. The vernalization treatment has reduced the flowering duration of rice by about 5 days.

Both diastase and catalase increase during the vernalization process. The treatment in light has caused greater increase than that in darkness. In the former treatment catalase decreases slowly until it is equal in both. When the seeds are germinated the increase in diastase is greater and that in catalase less than those of untreated germinating seeds.

Acknowledgment. I wish to express my gratitude to the Univerity of Madras for granting me a scholarship for two years to carry the investigations in Coimbatore. I am also grateful to K. Ramiah M. B. E., the then Paddy Specialist to the Government of Madras for guidance.

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SELECTED ARTICLE

Development of Modern Composting Methods.

By Y. D. Wad, Institute of Plant Industry, Indore, Central India.

The deliberate use of rotted organic wastes—vegetable and animal--for the purpose of growing larger quantities of better crops seems to be as old as the art of agriculture itself. It is conceivable that primitive man may have simultaneously (1) noticed the superiority of natural vegetation growing in virgin forest land rich in organic matter, and (2) discovered the possibility of artificial cultivation of some of the plant species suitable for his food.

At any rate, the importance of farmyard manure to crop growth has been stressed in ancient Indian and European literature on agriculture (Russell and Richards, 1917). Kind (1926) has described in detail how the Chinese peasants of old, took elaborate care to collect all available wastes and convert them systematically into well-rotted composts. It is noteworthy that in every part of the world this system of returning its own waste material to land has maintained soil fertility in spite of continuous cropping through the ages. The crowded population of China is still being maintained on the produce of its soil after its agricultural use for over forty centuries. This is perhaps the most convincing proof of the perfect balance of ancient systems of agriculture with their environment. It is very striking, indeed, that modern composting technique has very little to add to the basic principles underlying the Chinese method of making manure from agricultural wastes.

Liebig published in 1840 his essay *Chemistry in its application to Agriculture and Physiology.* This marked the beginning of a period when scientific investigations and commercial enterprise concentrated on the stimulation of crop production by means of factory-made chemical manure. Subsequent work at Rothamstead and elsewhere established the manufacture of artificial fertilizers on a sound footing. Factories engaged during the war in the fixation of atmospheric nitrogen needed new markets afterwards. This further intensified the use of chemical manures. The use of bulky farm manures fell into the background. It was even asserted that this practice was not an essential feature of agriculture. A school of scientific workers, however, soon arose who maintained that a certain proportion of humus is essential to preserve the crumb structure in soils and that such a structure in turn was essential for efficient plant growth (Russell, 1934; *Symposium on Soil Organic Matter*, 1927).

Another group of scientists (Howard, 1937, 2) believed that the artificial stimulation of soil activities for commercial cropping was sure to upset the natural balance of soil factors and in the long run might lead to evils not yet fully realized. They maintain, therefore, that in any agricultural system adequate provision is absolutely necessary for returning all the waste products of agriculture back to the land. Howard (1937,1) even maintains that in specialized systems such as the planting industries it may be necessary to make provision for the supply of humus to the soil by manufacturing it at extra cost from other sources to enable the soil to meet the abnormal strain resulting from highly intensive cultural practices.

Also, the large majority of the cultivators in the world still believe that the produce obtained by the use of chemical manures is not always equal in quality to that obtained by the use of ordinary farm manure.

Recent discoveries of workers on animal nutrition have apparently confirmed this belief by their findings (McCarrison, 1926, 1937; Viswanath and Suryanarayana, 1927; Ramiah, 1933). It has also been claimed (Howard, 1937,1) that the use of humic manures from vegetable and animal wastes imparts disease resistance both to crops and the animals that feed on them. Recently, a fresh impetus was received by the investigations into the nature of soil humus and the decomposition of organic wastes to humus (Russell and Richards, 1917; Waksman et al., 1929; Du Toit and Page, 1930, 1932; Waksman and Iyer, 1932, 1933; and others). This was accompanied by zealous attempts of other workers to discover how to make larger quantities of humic manures and how to increase the speed of the decomposition (Carbery and Finlow, 1928; Rao and Subrahmanyan, 1932, 1935; Anstead, 1932; Gadgil and Hegdekatti, 1937). These workers aimed at ensuring a copious supply of cheap aud properly made humic manure.

Richards and Hutchinson (1921) artificially converted straw to humus by the help of ammonium sulphate. This led to the development of the patented "Adco" process.

Fowler (1930) and Howard concentrated their efforts on the utilization of all available organic residues for making composts of the Chinese type. Fowler stressed that it is necessary to build up an intensively active biological starter of the proper type to ensure a good start and maintain the speed thus secured throughout the course of decomposition. His system of making "activated composts" is founded on this principle and is applicable equally to both farm residues and town wastes.

Howard aimed chiefly at making all types of residues into composts and thus increasing the supply of cheap humus. He saw in this a means to compensate for the existing shortage of cattle dung for manure-making in India where cattle dung is badly needed for fuel purposes in the absence of a satisfactory substitute. His work in this direction culminated the development of Howard and Wad's Indore Process (1931, 1935).

This process aims at utilizing the harder residues by making them less refractory to the influence of the fermenting microorganisms by the physical cracking of tissues or by exposing them to the corrosive environment of actively decaying material of a better composition. It lays special stress on starting the heap with a physical structure capable of maintaining adequate aeration without undue loss of moisture all through the period of decay notwithstanding its compaction due to the shrinkage of the rotting mass. It is maintained that a properly made heap will very soon develop within it all the required intensity of microbiological activity by itself. All the temperature ranges and sequences of the types of micro-organisms necessary for composting will automatically appear. The process is aerobic, clean and sanitary as well as cheap and simple. The final product always maintains the proper standard of quality.

This process, therefore, spread rapidly all over the world and is applicable to a large variety of cultural systems and environments. It can convert all types of wastes quickly into well-rotted composts. This is typically illustrated by its application (1) to the disposal of habitation wastes (Jackson and Wad, 1934, Howard, 1935, 1937, 1938), (2) the composting of cane trash (Tambe and Wad, 1935; Dymond, 1923, 1938) and of sisal wastes, the wastes of tea, coffee, rubber and coconut and oil palms (Bagot, 1937; Howard, 1938) and its modifications for making composts with rain water (Timson, 1939) and by the intermittent supply of water from canals (Jackson, Wad, and Panse, 1934).

Fowler (1930) seems to have considered partially anaerobic conditions during the later stages of decomposing heaps as having some beneficial effect.

The author of this note has observed that under the hot arid climate of the Rajputana desert the compost made with three turns had an inferior chemical composition than that produced by one turn only. It appeared that due to the different degrees in the course of fermentation of the various components of the heap the more easily decaying portions under the stimulus of local climate reached the stage of complete oxidation aud consequent losses by the time the more refractory parts were sufficiently crumbled down. It is possible that losses of this nature may be kept down by lessening the number of turns or altering their intervals to regulate the ventilation to the desired degree.

While investigating the possibilities of the hot fermentation process Rajgopal *et al.* (1936) have concluded that in compost heaps a better conservation of carbon and nitrogen is possible when anaerobic conditions follow after a vigorous aerobic start with rise of temperature. The mechanisms by which this is brought about is yet to be fully investigated.

Howard (1937) has recently evolved what he calls "Sheet Composting". This seems to suit wherever labour is scarce or costly. Residues of field crops are composted *in situ* in the field without collecting and removing them. The conditions in sheet composting are perhaps semi-aerobic. The following description by Howard will illustrate the application of this principle :—

This development was worked out during the last two years on the potato areas of South Lincolnshire which have been noted to suffer from shortage of humus. After the pea-crop grown for canning has been harvested, the land is immediately drilled with beans. The sown area is then covered with a layer of crushed straw from the shelling machines followed by a thin layer of farmyard manure. The Indore process then sets in on the surface of the soil. The beans grow through the fermenting mass and at the end of September are ploughed in with the layer of finished compost. Decay is rapid and by the time the fields are planted in potatoes the following spring the resulting humus has been incorporated in the soil and is ready for nitrification. This modification is known as sheet composting—the making of humus in a thin layer all over the surface. Catch crops of beans or mustard or a crop of weeds can also be manured with humus or farmyard manure before ploughing in in the autumn when sheet composting again takes place. The turf of old pastures or old leys can be converted into humus in a similar fashion. The Indore process has in this way been applied with success to no less than three important practical problems, green manuring, the effective utilization of weeds and stubble and the better utilization of the old turf of grass land.

Similar attempts at simplification are being made by applying waste organic matter direct to the soil with inorganic reinforcements (Eden, 1935, 1936). The present system of burying tea prunings and loppings of shade trees along with the chemical manures may also be considered a similar operation.

It appears to the author that perhaps the most economic and convenient method of returning waste material to land will be a preliminary aerobic decomposition to suitable stage followed by direct application to the field, a few weeks before sowing time, before preparatory cultivation begins. There seems to be some scope for such a method as it involves the least deviation from current routine as well as the minimum of labour and care. *Agriculture and Livestock in India* Vol. IX Part V.

Research Notes.

Agathi (*Sesbania grandiflora*, Pers.) Sesbania forms the last genus of the tribe Galegeae with a haploid chromosome number 7 (Galegeae n=8) Gamble gives a synonym *Agati grandiflora*, Desv. Five species are recorded from the Madras presidency.

Sesbania grandiflora is a tall growing woody plant with large showy flowers. Three colour varieties and two habit varieties have been met with. The chief characters of these types are summarised below :—

(1) Habit varieties according to the height=Tall and short (tending to be bushy).

(2) Colour varieties (according to the manifestation of the anthocyanin pigmentation (purple in the flowers)=white, medium-red, and red

Variety Colour	Flowers.			Lengths in cm.			Height of plant cm.
	standard	wings	keels	leaf	flower	pod	
White	White, light purple streaks on inner side.	No colour.	No colour.	·24	10	50	450—600
Red-medium	White, light purple wash on inner side.	Dorsal margin and tip faintly light purple.	No colour.	21	9	50	450—600
Red	Deep purple on both surfaces.	Deep purple on both surfaces.	Deep purple on both surfaces.	17	7	30	210—300

Apart from these morphological differences it was also noted that the verieties showed a definite trend in their first flowering after sowing. The older plants, of course, showed stray flowering throughout the year. A series of monthly sowings were done at Coimbatore to determine the optimum time for sowing and also the period required for flowering relatively to such sowing. Two of the varieties, the common 'white' and the 'red' were used for this experiment. The following observations were made :—

(1) The flowering season for the whites is in December and January, and that for the reds is from August to March.

(2) The plants require a definite minimum vegetative growth before they could produce flowers. This in the case of the tall whites (with a narrow flowering period) is 7½ months. In the case of the short reds (with a wider flowering period) it is 4 months.

(3) The height decreases as the sowings approach the flowering time. The height of the plants at the time of first flowering I reduces according to the duration upto the flowering time, provided the required minimum growth period is satisfied.

(4) The plants standing longer than a year do not obey this periodicity completely. The maximum flush of flowers and pods is as noted above, but the plants show stray flowering all through the year.

(5) The optimum time for sowing is about the beginning of August.

The reciprocal crosses of the three colour varieties *inter se* were done, with a view to study the inheritance of characters. Only the F_1s were raised. The following is the behaviour of the F_1s of the various crosses.

Red X medium-red. F_1s (5). Standard—back paler than mother, inside similar to mother. Wings—similar to father. Keel—very faint streaks of purple. Average length of flower—7·4 cm. (like mother). Average length of pod—46·3 cm. (intermediate). Height of plants—about intermediate (300 cm.).

Medium red X red. F_1 (1). Similar to reciprocal but colour slightly more in quantity.

Red X white. F_1s (3). Colour of flower similar to cross red X medium, Average length of flower—7·2 cm. (like mother). Average length of pods—49 6 cm (like father). Average height of plants—342 cm. (intermediate).

Medium-red X white, and white X medium-red. F_1s (3). Standard similar to medium. Wings and keel—no colour. Length of flowers—8·4 cm. (intermediate) Length of pods—no change. Height of plant—no change.

It is seen that in these crosses the anthocyanin pigmentation inheritance shows the F_1 intermediate although there is a definite tendency for the higher grade of pigmentation to dominate. Other characters are intermediate.

Agricultural Research Institute,
Coimbatore, S. India.
21st January, 1940.

G. N. Rangaswami Ayyangar.
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SNAILS AS PESTS OF PADDY

Inroduction. Snails have been reported as pests of paddy from Burma as early as *1917* (a). In Madras it was only in *1936* (b) that reports regarding the severe damage to paddy by snails were received. In 1937 and 1938 also there were reports but the damage done was not so severe as in 1936.

Species of snails affecting paddy. Four species of snails *Viviparus variatus*, *Frauenfled*, *Pila vireus* Lamarck, *Indoplanorbis exustus*, Deshayes and *Limnaea acuminata*, Lamarck form *rufescens*, Gray were collected from the affected fields. Of these the first mentioned was present in large numbers in all the areas; the second and third were distributed in all the areas but not in such large numbers as the first. The last one was collected only from one of the fields.

Nature of attack. Snails cut the transplants as a result of which the top portions float on the surface of the water. The cutting of the stems is a slow process; about 2 to 3 hours being taken to cut a stem of 1/3" in thickness. The transplants are cut 3" to 4" from the base below the surface of the water in the field. The cut ends showed an irregularly serrated surface. The snails were active only during nights getting on to the plants after dusk. The presence of water in the fields facilitated the movements of the snails. In the absence of water the snails were found stuck up in the puddle by the weight of their shelf. In a few fields where the water was drained off, the temperture on a hot day was sufficient to kill most of the creatures.

(a) Report of the Proc. of the Second Entomological meeting—Pusa—1917, page 160.

(b) Administration reports of the Govt. Agricultural Chemist, Entomologist, and Mycologist for 1936—37, page 21.

Localities affected and extent of damage. In 1936 the pest was severe in Kaikalur, Bundar and Gudivada taluks in the Krishna Dt and Bapatla taluk in Guntur Dt. The areas affected were mostly situated at the end of channels comprising low-lying fields. In some of the worst affected fields in Kaikalur taluk, there was severe loss and the fields had to be transplanted.

Association with crabs. A few crabs were also seen along with the large number of snails in the fields but their number was very limited. The major attack was by snails.

Agricultural Research Institute, Coimbatore. 4th April, 1940.

M. C. Cherian,
P. S. Krishnamurthi.

ABSTRACTS

Magnesium-deficiency of fruit trees. Wallace, T.—J. Pomol, 1939, 17:150—66, bibl. 31.

An account of previous work relative to magnesium deficiency in various countries and for various crop plants is given and the possible role of magnesium in plants is discussed. Reference is made to the relationship of magnesium to calcium and potassium and to the problem of magnesium-toxicity in plants. The possible importance of magnesium-deficiency in problems of spray injury is indicated. Evidence of magnesium deficiency in apple trees at 3 centres in England is given and it is shown how the composition of the leaves of terminal shoots may be used to determine the condition of the foliage with regard to supplies of lime, magnesia and potash. Where supplies of calcium and magnesium are adequate in apple leaves the amounts present are similar to those in tobacco leaves of satisfactory quality. Methods of treating soils with magnesium containing materials in cases of magnesium-deficiency are given. (*Horticultural Abstracts* 9 (1939): 233).

Spray injury studies. Progress report 1. Some observations on the probable causes of lime-sulphur injury.—Berry, W. E. and A. R. Long, Ashton Res. Stat. for 1938, 1939, pp. 124—44, bibl. 29.

Symptoms of lime sulphur injury are described and a list presented showing the relative susceptibilities of some varieties of common fruit plants to sulphur injury. The penetration of spray materials into the leaf is discussed with particular reference to cuticle permeability and the effect of nutritional climatic factors. An experiment is described which suggests that foliage injury from lime sulphur may be correlated with temperature, humidity low and sunshine. Maximum injury occurred when temperature was high, humidity low and sunshine continuous. The possibility that desiccation by spray deposit may be a major cause of injury was investigated. Concentrated sprays of surcrose and calcium chloride produced little damage compared with lime-sulphur. It is concluded that loss of water due to the purely osmotic effect of spray deposit is not alone responsible for spray injury. Detached leaves of Lane's Prince Albert and Laxton's Superb apples exhibit rapid increases in respiration when sprayed with 2% lime-sulphur and show symptoms of injury similar to those observed in the field. Necrotic patches are believed to result from local penetration of spray fluid but the increase in respiration seems due to more general physiological effect on the whole leaf. Possible causes of the observed effects are discussed and it is due to gaseous or volatile compounds, which, the evidence suggests, may be hydrogen sulphide. (*Horticultural Abstracts* 9 (1939): 240)

EXTRACTS

Liming.

Sir A. D. Hall, the late Director of the Rothamsted Experimental Station once said, "Of all soil factors making for fertility, I should put lime the first. Upon its presence depend both the processes which produce available plant foods in quantities adequate for crop rotation at a high level and those which naturally regenerate and maintain the resources of the soil." The action of lime on different soils is physical, chemical and biological. Physically the action is one which improved soil texture. This is most mainfest on strong soils where it acts by flocculating the finer clay particles. The heavy soil thus becomes less retentive of moisture, warmer and better aerated, allowing earlier spring cultivation and becoming more friable when dry. On light sandy soils the action of lime is apparently opposite to that on heavy clay soils, in as much as it tends to bind the particles together, increasing the cohesiveness of the soil and improving the moisture relationships. Chemically, lime has the important function of tending to correct soil acidity. Sour soils contain free acids present in sufficient quantities to be injurious to plant life, and such soils are "sweetened" by its application. Lime is able to liberate inorganic plant foods from combination in the soil, and they then become available to the plant. The fertility of a soil does not depend upon the total plant food present, but upon the amount of available plant food present. Lime has its biological effect in discouraging harmful or undesirable micro-organisms and encouraging beneficial ones. The process of nitrification in which organic substances are converted into nitrates is brought about by certain types of soil bacteria, and these cannot carry on their necessary work if the soil is too acid. Plant life is also influenced by the relative acidity of the soil. For instance, plants such as sorrel, favour more acid conditions, while those of the legume family e. g., the clovers, requires a soil relatively rich in lime.—*Tasman. Jour. Agri* 10 (1939) : 1935.

The Use of Colchicine.

(By Claud Saunders.)

From reports of a remarkable really new discovery made by scientists at the Carnegie Institution in the United States, it seems that gardeners may look forward to growing gigantic forms of existing plants from seed in the near future.

The discovery, which is likely to have far-reaching effects, concerns the effect of a drug, called Colchicine, on the growth of plant. The drug itself is extracted from a well-known flower the Autumn Crocus, and is used in the treatment of rheumatism. When a solution of the drug was sprayed very very finely on growing plants, it was discovered that their growth became very abnormal, twisted and deformed. Among such deformed plants and flowers it was found that some developed to out-size proportions both of the plant and its flowers. What is even more striking is the fact that seed saved from the giant plants among the drug-teoted treated inherits the giant characteristics of its parent; and without any special treatment, the seed grows into an enlarged edition of the original plant.

Treatment with the poisonous drug, either by spraying or injecting the solution into the plants or by treating the seeds, may be carried out on plants of the first generation of giants to produce a further increase in size. I suppose that there must be a limit to the number of times the drug can be used to increase in size; but apparently treatment has been repeated to produce plants at least four times their original size.

Another remarkable effect that the Colchicine treatment has been revealed to have on plants is in altering the number of cells that carry the characteristics of a plant. By being enabled to control this now, plant-breeders will be able to attempt to cross unrelated species of plants with a big chance of success As a result of this, in the course of time we are likely to have many strange hybrid plants in our gardens. Even where species crosses have been made between plants in the past, the hybrids more often than not, will not produce seeds. It appears however, that the use of the drug by hybridizers will ensure that new crosses will be fertile and produce seed freely. Some of the plants of which giant new forms have been produced by the experimenters at the institution include, I understand, cosmos, foxgloves, nasturtiums, onions, phlox and radishes. I learn, too, that commercial plant breeders and seed growers are making use of the discovery and soon, no doubt we shall be able to enjoy the results in our gardens. Though it is a fascinating thought to look forward to growing giant specimens of existing plants from seed and new hybrids, I believe successful results from the wonderful new treatment are not attained without much careful and patient work in breeding and selection. *The Gardner* Vol. 3; No. 4.

Gleanings.

Curative Properties of Pine-Apple. Pine apple juice is an excellent remedy for lumbago and kindred ailments. In doses of 6 to 8 ounces taken 3 to 4 times a day in an undiluted form and sweetened to taste, it relieves pain in the course of two or three days and almost brings about a complete cure in five or six days. If the juice is taken immediately after lumbago appears, the patient does not develop the painful form. The juice is quite pleasant and agreeeble that one takes it not as a medicine but as an excellent cordial or beverage. Scrape off the hard outer coat, grate the entire fruit to pulp with the aid of a grating tin plate common in the Indian household. Another efficient method of grating pine apples consists in cutting the fruit across into two and scraping out the 'meat' with the aid of a coconut scraper of the Malabar pattern. The shell and the hard core are left intact while all the meat is scraped off. The juice is then pressed through cheese cloth or other suitable tough material.

New achievements in the Biological sciences in 1939. Experiments showed that Light, either artificial or from the sun, serves to increase the ability of plants to withstand midsummer heat.

A new method was devised for measuring soil moisture, by passing electric current through a buried block of gypsum.

Seedless watermelons were produced by chemical treatment of unpollinated flowers.

A plant growth-retarding substance was discovered.

A substance that makes plant wounds heal was discovered and named traumatic acid.

Legs were successfully cross-transplanted among embryos of chickens, turkeys and other fowl.

Colchicine was extensively applied in the breeding of new varieties of plants.

A new type of rubber cavity filling for tree wounds was designed to provide an inexpensive treatment.

A new co-operative system for artificially inseminating cows, ewes and other farm animals was inaugurated in several states. *Science supplement.* Vol. 90 No. 2347 December 22 1939.

Crop & Trade Reports.

Subject:—Statistics—1939-40—Cotton—Fourth forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1937-38 has represented 9·9 per cent of the total area under cotton in India.

2. The area under cotton up to the 25th January 1940 is estimated at 2,102,900 acres. When compared with the area of 1,873,900 acres estimated for the corresponding period of last year it reveals an increase of 12·2 per cent.

322,600 acres have been reported as sown since the last December forecast was issued. This extent comprises chiefly 214,800 acres under Tinnevellies including Karunganni in Coimbatore, 50,600 acres under Cambodia, 26,000 acres under white and red northerns, 16,000 acres under westerns, 11,600 acres under Warangal and Cocanadas and 3,800 acres under Salems. The area sown in December and January falls short of that sown in the corresponding period of the previous year by 45,900 acres or by 12·5 per cent.

3. The increase in area in the current year as compared with the area in 1938-39 occurs in all the important cotton growing districts of the Province outside Guntur, Nellore and Tinnevelly and is attributed to favourable rains and good prices during the sowing season. The variations are marked in Coimbatore (plus 94,500 acres), Madura (plus 23,500 acres), Ramnad (plus 23,600 acres) and Tinnevelly (—32,400 acres). The area estimated in respect of Guntur and Nellore districts is the lowest reported in recent years.

The area under irrigated cotton, mainly cambodia, is estimated at 180,900 acres as against 162,200 acres for the corresponding period of the previous year, an increase of 11·5 per cent.

4. Pickings of the mungari or early sown cotton crop in the Deccan have concluded. The yield was slightly below normal due to the bad bursting of bolls.

The crop was affected to some extent by drought in December in the districts of Madura, Ramnad and Tinnevelly. Normal yields are reported from all districts except South Arcot, Tanjore, Madura, Ramnad, Tinnevelly and Malabar where the yield is reported to be below normal.

5. The seasonal factor for the Province as a whole works out to 97 per cent. of the average as against 94 per cent. in the previous year. On this basis, the total yield is estimated at 435,400 bales of 400 lb. lint as against 375,800 bales for the corresponding period of the previous year. It is however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and the toll taken by insect pests.

6. The estimated area and yield under the several varieties are given below.

(Area in hundreds of acres, i. e., 00 being omitted; yield in hundreds of bales of 400 lb. lint i. e., 00 being omitted).

Variety.	Area from 1st April to 25th January		Corresponding Yield.	
	1939-40.	1938-39.	1939-40.	1938-39.
1	2	3	4	5
	Acres.	Acres.	Bales.	Bales.
Irrigated Cambodia	1,684	1,530	1,034	879
Dry Cambodia	1,828	1,784	378	341
Total Cambodia	3,512	3,314	1,412	1,220

Variety.	Area from 1st April to 25th January.		Corresponding Yield.	
	1939—40.	1938—39.	1939—40.	1938—39.
1	2	3	4	5
	Acres.	Acres.	Bales.	Bales.
Uppam in the Central Districts.	258	186	41	27
Nadam and Bourbon.	201	33	10	2
Total, Salems.	459	219	51	29
Tinnevellies*	6 438	5,152	1,499	1,226
White and Red Northerns	1,930	1,780	241	222
Westerns	7,600	7,040	951	846
Warangal and Cocanada	1,017	1,176	191	208
Chinnapathi (Short staple)	73	58	9	7

* Includes Karunganni Cotton grown in the Coimbatore District and Uppam, Karunganni and mixed country cotton grown in the South.

7. The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. as reported from important markets on 5th February 1940 was about Rs. 22—1—0 for Cocanadas, Rs. 23—12—0 for White Northerns, Rs. 25—8—0 for red Notherns, Rs. 25—10—0 for westerns (Jowari crop), Rs. 22—13—0 for Westerns (mungari crop), Rs. 33—15—0 for Coimbatore Cambodia, Rs. 31—0—0 for Southern Cambodia, Rs 31—11—0 for Coimbatore Karunganni, Rs. 30—7—0 for Tinnevelly Karunganni, Rs. 30—10—0 for Tinnevellies and Rs. 24—11—0 for Nadam cotton. When compared with the prices published in the last report, i e., those which prevailed on 8th January 1940, these prices reveal a rise of about 19 per cent in the case of red Northerns and 11 per cent in the case of white Northerns and a fall of about 7 per cent in the case of Western (mungari crop), 5 per cent in the case of Cambodia (Coimbatore and the South), 3 per cent in the case of Westerns, (Jowari crop), and Tinnevelly Karunganni, 2 per cent in the case of Cocanadas, and one per cent in the case of Coimbatore Karunganni and Tinnevellies, the prices remaining stationary in the case of Nadam cotton. (*From Director of Industries, Madras*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses, and spinning mills in the Madras Presidency from 1st February to 12th April 1940 amounted to 87,850 bales of 400 lb lint as against an estimate of 366 800 bales of the total crop of 1939—40. The receipts in the corresponding period of the previous year were 86,636 bales. 112,562 bales mainly of pressed cotton were received at spinning mills and 5,120 bales were exported by sea while 38,770 bales were imported by sea mainly from Karachi and African ports. (*From Director of Industries, Madras*)

Mofussil News and Notes.

Dharmapuri—Admancotta—Cattle Fair and Agricultural Exhibition. The biggest cattle fair in this taluk is held during the descending phases of the Moon in the month of *Panguni* in Admancotta—a village 5 miles from Dharmapuri R. S. Most of the stock of animals brought to the fair for sale are of Alambadi breed—from the neighbouring taluks. This year the fair was held from 26th March to 2nd April and during this week, as many as 60,000 animals were assembled. The prices ranged from Rs. 300 downwards per pair.

An agricultural exhibition was held during this period which attracted a large gathering. Improved varieties of different crops, green manure crop seeds, improved strains of sugarcane were placed for exhibition, in addition to improved implements.

A similar cattle fair, though not a big one, will also be held during the last week of April at Indur—a village 8 miles from Dharmapuri. P. V. S.

Givada Agricultural Exhibition. An agricultural exhibition was held at Givada in Tenali Taluq, on 7th and 8th March 1940, during the 4th Annual cattle show held under the auspices of the '*Gunturuseema Rytu Sangham*', during the Sivarathri festival, which attracted large crowds from various places. Lectures on improved methods of cultivation and gardening were delivered by the agricultural demonstrator, Tenali. N. R.

Guntur Divisonal conference. A conference of the Demonstrators of the Guntur division was also held at Vuyyur and valuable discussions were held. Excellent arrangements were made by the Sugar Factory authorities for the stay of the officers and for visitors to the factory.

Month gathering of officers at the Agricultural Research station, Guntur :— At the instance of Mr. R Swami Rao. Asst. Director of Agriculture, Guntur all the officers of the Agricultural and live stock Research Stations and those working at Guntur along with some of the prominent ryots of the locality, meet early every month at the Research Station, at a social gathering and discuss various topics of interest. This has become a regular feature and affords an opportunity to study the problems arising out of the work at the station in company with others whose advice and suggestion are likely to be valuable. S. V. D.

Karamadai Agricultural Exhibition. An Agricultural Exhibition was held at Karamadai from 23rd February 1940 to 25th February 1940, during the Car festival. Demostrations on Bee-Keeping and honey extraction were conducted during these days and lectures on Bee-Keeping, crop production and Insect pests and Diseases control, were delivered in the evenings.

The cattle fair conducted by the Local Boards attracted large crowds and nearly 1500 pairs of work animals, mainly Alambadis from Mysore tract, were brought in for sale:— The best pair was sold for Rs. 1050. K. H. S.

Mannargudi Agricultural Exhibition. An Agricultural Exhibition was held at the premises of the Municipal office during the Health and Baby week at Mannargudi from the 14th to 17th February 1940. The exhibition was opened by Sri V. N. Ramanatha Rao, the District Munsif of Mannargudi. Among the various exhibits put on show, special mention may be made of malt foods from Ragi, cholam and rice, samples of different fruits and vegetables, honey etc. A good number of visitors visited the show and they were taken round and shown by the officers of the Agricultural Department. A. G. N.

Pattukottai :—Agricultural Exhibition at Nagaram. An Agricultural Exhibition was held on a large scale at Nagaram during the "*Pangani Utharam*" festival from the 21st to 25th March. Chief varieties of Paddy and rice, improved breeds of poultry from Aduturai, Oil seeds from Tindivanam, Sugarcane varieties and fodder crops from Pattukottai Farm, Millets from Palur, samples of Coconut seed nuts from Kasargod, Pine apple fruits from Pattambi, malts from the Govt. Agricultural Chemist, green manure seeds and plants, bee hive with accessories, plantain, fig, graft plants from Panyam and various labour saving implements and charts on Agricultural subjects were exhibited. Demonstrations were held on bee keeping. Lectures with the aid of magic lantern were delivered by Agricultural and Health Departments.

During the exhibition ryots reported attack of insects in chilli crop. Gardens were inspected and tobacco emulsion was sprayed for aphis and mealy bug.

A. G. N.

Tiruchendur :—Cattle Fair, at Tiruchendur in Tinnevelly District. The Tinnevelly District Board conducts a cattle Fair every year at the famous pilgrim centre Tiruchendur, during the *Masi Magam* Festival. During this year the cattle fair was held from 18—2—40 to 3—3—40 and some 8,000 beads of cattle assembled. The Agricultural and Health departments arranged exhibitions from the 24th to 29th February 1940. Improved implements, pure seeds of paddy, strains green manure seeds, samples of cotton and ground nut, artificial fertilizers and concentrated organic manures were exhibited by the Agricultural Department. Pest and disease control methods and bee-keeping were also demonstrated. A large number of visitors were greatly benefitted by the exhibition. R. C. P.

College and Estate News.

Students' Corner. *Farewell to Final year Students* :— The customary function of bidding farewell to the out-going students came off on 19—3—40, when the students of 1st and 2nd year B. Sc. Ag., were 'At Home' in the Freeman Hall to the final year and short course students. After tea, speeches on behalf of the lecturers, tutors, coaches and representatives of the various classes were made. The function terminated with the concluding speech by the Principal, Mr. R. C. Broadfoot, wishing the outgoing students all success in life.

A committee of hosts were 'At home' to the Final year students at a Tea Party held on 24—4—40 in the Hostel quadrangle.

Annual Dinner at the students' Hostel. The students of the Agricultural College Hostel met some officers on the Estate at a delightful dinner party on 27—3—40 at the long block of the hostel.

University Examinations. The University Examination for the B. Sc. Degree in Agriculture was conducted from 1--4—4) to 16—4—40. The practical examinations were all over by the 23rd instant.

Personal. On the eve his transfer, Dr. M. K. Nambiar of the Lawley Road Dispensary, was entertained by a few residents on the Estate at a delightful dinner party in the premises of the officers club on 5—4—40.

Mr. M. K. Venkataramana Mudaliar, Veterinary Asst. Surgeon of the college veterinary Hospital, who was under orders of transfer to Annur, was met at a dinner party by his friends on 17—4—40 in the premises of the officers' Club.

Dr. R. Sankaran has left the Institute to take up the new appointment as Cotton Botanist, Sind.

Visitors:— Mr. K. T. Alwa Headquaters Deputy Director of Agriculture, who came here as an external examiner in Agriculture, stayed in the Estate from 14—4—40 to 18—4—40.

Dr. B. N. Iyengar, Retired Director of Agriculture, Mysore, an examiner in Chemistry for the recent B. Sc. Degree examination was here from the 16th to 18th instant.

Obituary :—*The Late Rajah Sir Venganad Vasudeva Rajah of Kollengode*:— We regret to record the death of Rajah Sir Venganad Vasudeva Rajah of Kollengode on 7—4—40 at Bombay. The late Rajah was a patron of the Madras Agricultural Students' Union.

The late T. Varahalu, B. A., M. Sc:— We deeply regret to record the sudden death of T. Varahalu on 9—4—40 under tragic circumstances. The late Mr. Varahalu was born on 8th February 1901 in Vizagapatam District. He entered service in the Agriculture Department on 6—7—1926 and was throughout a very enthusiastic and energetic assistant in the Chemistry section. He was a regular contributor to the *Madras Agricultural Journal* and his contributions on the 'Chemistry of Jaggery' have been greatly appreciated by the readers of the Journal in and out of India. He was also a winner of the Ramasastrulu Munagala Prize. We deeply mourn his loss and convey our heartfelt condolences to the members of the bereaved frmily.

The Agricultural college Estate, Ladies club:— In the General body meeting held on 18—4—40, the following office bearers were elected for the year 1940—41.

President:— Mrs. K. M. Thomas. Vice-President:— Mrs. H. Shiva Rao. Secretary:— Mrs. K. Sanjiva Shetty.

GREEN LEAF MANURE

[*We publish below a valuable Prese note issued by the Govt. of Madras, Development Department. Ed. M. A. J.*]

Water and manure represent the principal requirements of an agricultural population. In some respects the latter is a more important requirement for it is axiomatic that what is taken off the land by grain crops must be replaced or else the crop productivity will diminish. This replacement is done by the application of manures to the fields. Of the manures, both chemical and farm yard manures are costly and beyond the means of most of the poor ryot. He is left with only Green Leaf manure. Suitable trees and shrubs grow everywhere. The ryots lop a variety of trees, in fact any broad leaved species, their availability being the main desideratum but the following species are preferred :

Botanical name.	Tamil.	Telugu.	Kanarese.	Malayalam.
Tephrosia purpurea	*Kolinji*	*Vempali*	*Kogge*	*Kolinnil*
Pongamia glabra	*Pungam*	*Kanuga*	*Honge*	*Punnu*
Dodonea viscosa	*Velari*	*Bandari*	*Bandare*	*Unnataruvu*
Cassia auriculata	*Avaram*	*Tangedu*	*Taugedi*	*Vviram*
Adathoda vasica	*Adadodai*	*Addasaramu*	*Adusoge*	*Atalotakum*

The last species is important in that it acts as a weed exterminator,

2. **Mode of use.** The fields are flooded and the green leaf manure is spread evenly, trodden in and allowed to rot. A week later the agricultural crop is introduced.

3. **Sources of supply.** The rich ryot grows his own manure leaf trees, usually *Pongamia glabra* and *Cassia spp.*, but the majority depend on trees growing either on private or state property, especially the latter. Unreserves and reserved forests belonging to Government have to meet most of the demand. With the gradual breaking up of the unreserves for cultivation and the depletion of the tree growth in them, the demand on the reserves has been on the increase.

4. **Policy of the Government.** This demand on the reserves for leaf manure was recognised by the Government as early as 1903 and the Forest Department was asked to make provision for its supply to the public, at a cheap rate. At the same time the Government realised that manure leaf removal was incompatible with the realisation of the more important objects of management of forests, namely, that of supplying the various other (and more important) domestic and agricultural needs of rural life. So they asked the Agricultural Department to endeavour to popularise the cultivation of manure leaf crops by the people themselves. The Government have declared in unequivocal terms that their ultimate aim was the total prohibition of leaf manure removal from the forests and that everywhere it was time that the agriculturist ceased to depend on the forests for this product.

4 (a). The reasons for the formulation of the above policy by the Government can be easily understood. To derive the fullest benefits from the forests two things must be ensured—the vigour of the trees should not be impaired, and the leaf canopy should not be interfered with, especially in the growing season. Leaf manure removals jeopardise both. Pollarding for leaf manure usually takes place in the rainy season, which is the main growing season of the forest trees. The trees bereft of their full leaf cover naturally put on less increment, since leaves are the principal manufacturers of plant food. Further they spend their energy in trying to reclothe themselves. The trees naturally stagnate under such treatment and ultimately die. With the absence of full leaf cover in the rainy season, the mechanical obstruction which leaves offer to rain drops is greatly reduced and soil erosion, one of the greatest calamities that can occur to a nation, follows. Soil manufactured in thousands of years is lost in a single downpour. Under repeated pollarding, the potential soil value of the forests also diminishes and they can no longer bear trees of good quality.

4 (b). We cannot afford to manure the forests artificially and the only manure they get are the leaves which drop from the trees, and are transformed into humus. If the leaves are lost, the fertility of the forest soil must necessarily deteriorate, and it is false economy for the nation to sacrifice their forests in order to assist the more short-sighted agriculturists. Thus it will be seen that removal of leave manure is fundamentally opposed to the first principles of forestry. If the forests are to take their rightful place in the national economy, leaf removals must be prohibited. Such prohibition cannot, however, be completely enforced at once, without hardship to the agriculturist. He must first be taught to grow his own crops of leaf manure.

5. **History of the Methods of Supply of Leaf Manure by the Forest Department.** First the ryots were permitted to remove leaf manure from specified species in the forests, on their buying a permit for the same ; but, in actual fact, removals were not confined to these species and this led to the rapid deterioration of the forest growth. The trees became moribund and ultimately died under repeated pollarding, and it was not possible to control the removals, which were wide spread and usually took place in the early hours of the morning. A Forest Guard on whom the protection of nearly 10 square miles of forests depends, even if he wants to, cannot see that the felling rules relating to leaf manure removals are obeyed by the public. Further on account of the scattered nature of the exploitation and the unsuitability of the soil in many cases for practising the cheeper methods of regeneration, it is not possible to replace the dying trees by new ones.

6. In view of the above disadvantages the permit system is being replaced by the coupe system. Manure leaf series containing two or three coupes are formed in localities, from which the ryots are accustomed to remove their leaf manure. While removal takes place in one coupe the other coupes are given rest so that the trees in them may recover. The success of this system depends on the proper location of the series ; if they are at a distance from his village, the average ryot does not put himself to the trouble of getting his requirements from them, but helps himself elsewhere. This, to a large extent prevents our locating the series in places where cheap methods of artificial regeneration will be possible. Under the coupe system it has been found possible to increase the stocking of manure leaf species, by artificial methods, but not to the extent we would desire, because finance is a ruling factor. But where manure leaf removals have to be permitted from the reserves, the coupe system does less harm than the permit system. Even this coupe system is not the last word on the subject. No doubt the trees get some rest before they are pollarded again, but this will only retard the destruction of the trees, without averting it.

7. Recent experiments have indicated that regeneration of tree species with *Kumri* cultivation is the cheapest method, and this practice can be adopted for raising manure leaf plantations either in forest reserves or elsewhere. *Kumri* consists of the intercultivation of tree species with field crops. This method costs the Forest Department little or nothing, for the *Kumri* cultivator gets the benefit of the field crop, and in return raises and looks after the forest crop during the period he cultivates the land. But this *Kumri* method can be tried only in arable localities. Manure leaf species may be raised in this manner and they can be pollarded for leaf manure till the trees show signs of stagnation. Then the whole area can be clear felled and the cut plant growth burned on the land itself and a new crop of manure leaf plants can be raised by the *Kumri* method. The burning and the resultant ash will restore, at least partially, the fertility of the forest soil. The above seems to be a distinct possibility for the future and it is intended to try this method, with the co-operation of the public, in fairly level localities where erosion is unlikely, but where green leaf manure is necessary and where, at the same time, there is a demand for land on these terms.

8. **Green Leaf Manure supply and the Agricultural Department.** The experiments conducted by the Agricultural Department have revealed *that much better grain crops can be grown with the aid of green manuring crops raised on the land itself, and ploughed in than by the application of tree leaves.* The mechanical effects on the soil, of a crop grown "*in situ*" and ploughed in, are much more permanent than those of tree leaves carted from outside and applied to it.

For an expenditure of Rs. 5 per acre, a green manuring crop can be produced which will give results equal to the application of Rs. 25 worth of oil cake (Poonac).

9. About 12 tons of green manure per acre have been produced by sowing *Sesbania acùleata** (Telugu :— *Errajiliga ;* Tamil :— *Mudcombai, Nircombai ;* Malayalam :— *Kittenna,*) a good green manure, on the wet lands, after the paddy crop had been harvested. One acre under this plant will produce sufficient green manure for at least four acres, i. e. it will come to three tons or eight cartloads per acre, the quantity which an average ryot applies to his land per annum. So the cost of green manuring an acre according to the above method will come to only Re. 1—4—0, whereas if the ryot wants to get the same quantity of green leaf manure from the reserve, he will have to pay the Forest Department Rs. 16 at the rate of Rs. 2 per cartload permit. In addition he has to bear the cost of collection. This shows how remunerative it will be for ryots to raise their own crop of green leaf manure.

10. The above facts, based as they are on extensive experiments carried out by the Agricultural Department, prove that the ryots need not necessarily depend on the reserves and the unreserves for their green leaf manure; they themselves can raise it without difficulty, at a low cost and without much trouble. In this connection it is reassuring to read from the reports of the Agricultural Department that the practice of growing green manure crops is increasing in popularity in the Presidency, and it is hoped that the demand on the reserves and the unreserves for leaf manure will progressively diminish, and ultimately die out, leaving the forests to fulfil their proper functions, instead of subjecting them to an additional and *unnecessary* demand, which always involves their deterioration, and ultimately must lead to their complete destruction.

C. P. Karunakara Menon,
Secretary to Government, Development Dept.

* Popularly known as *Daincha* Ed. M. A. J.

Correspondence.

To

The Editor,

Madras Agricultural Journal.

Sir,

Messrs The Mysore Spun Silk Mills Ltd., Channapatna (Mysore State) are prepared to purchase pierced Eri cocoons at 8 to 12 annas per lb. F. O. R. Channapatna depending on the quality. Further particulars can be had from the company direct.

Yours truly,
M. C. Cherian,
Government Entomologist.

Coimbatore,
April 18, 1940.

Weather Review—MARCH 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·9	+6·4	7·0	South	Negapatam	0·0	-0·3	0·1
	Calingapatam	3·8	+3·4	4·1		Aduthurai *	0·0	-1·4	0·2
	Vizagapatam	1·4	+1·1	1·8		Madura	0·6	+0·1	0·6
	Anakapalli*	1·4	+0·9	4·6		Pamban	0·0	-0·5	2·2
	Samalkota*					Koilpatti*			
	Maruteru*	1·8	+1·6	1·8		Palamkottah	0·1	-0·9	0·2
	Cocanada	3·0	+2·5	3·0					
	Masulipatam	2·7	+2·4	2·7					
	Guntur*	4·0	+3·9	4·0	West Coast	Trivandrum	0·0		0·0
						Cochin	0·0	-2·0	0·1
Ceded Dists.	Kurnool	0·0	-0·3	0·1		Calicut	0·0	-0·5	0·1
	Nandyal*	0·0	0·0	0·0		Pattambi *	0·0	-1·0	0·0
	Hagari *	0·0	-0·2	0·0		Taliparamba *			
	Siruguppa*	0·0	-0·2	0·0		Kasargode *	0·0	-0·6	0·0
	Bellary	0·0	-0·2	0·0		Nileshwar*	0·0	-0·3	0·0
	Anantapur	0·0	-0·2	0·0		Mangalore	0·0	-0·1	0·0
	Rentachintala	0·1		0·1					
	Cuddapah	0·3	+0·1	0·3					
	Anantharaju-				Mysore and Coorg	Chitaldrug	0·0	-0·3	0·0
	pet *	1·0	+0·8	1·0		Bangalore	0·1	-0·4	0·1
Carnatic	Nellore	0·8	+0·6	1·0		Mysore	0·0	-0·3	0·0
	Madras	0·2	0·0	0·3		Mercara	0·0	-0·6	0·0
	Palur *	0·0	-1·9	0·0					
	Tindivanam *	0·0	-1·5	0·6	Hills	Kodaikanal	1·4	-0·6	1·4
	Cuddalore	0·3	+0·1	0·6		Coonoor			
Central	Vellore	0·1	-0·1	0·1		Ootacamund *	0·5	-0·2	0·5
	Salem	2·3	+1·8	2·3		Nanjanad *	0·0	-1·0	0·0
	Coimbatore	0·1	-0·4	0·1					
	Coimbatore A. C. & R. I.*	0·2	-0·6	0·2					
	Trichinopoly	0·3	-0·1	0·3					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather Review for March 1940. The weather was generally dry over the peninsula except on the North Madras Coast during the beginning of the month when secondary low pressure areas derived from western disturbances traversing upper India, caused thunder storms and rain. In the south of the peninsula thunder storm activity was very low and only about the 25–26th a few scattered thunderstorms occurred in the vicinity of the hills.

Rainfall was in large excess in the North Madras coast and was generally in defect elsewhere. The chief falls reported were:

	Calingapatam	3·3 inches on the 9th.
	Gopalpore	1·6 inches on the 8th and
		1·3 inches on the 28th.
and	Salem	1·2 inches on the 26th.

Skies were moderately to heavily clouded in the North Madras Coast, Malabar and North Konkan; and lightly to moderately clouded in South East Madras; and clear or lightly clouded elsewhere. Humidity was in excess in the Bombay Deccan and parts of North Madras Coast, and was in defect in South Deccan, Malabar and South East Madras. The maximum and minimum temperatures were below normal in the Bombay Deccan and North Hyderabad while they were above normal in South East Madras and South Hyderabad.

Weather Report for the Agricultural College and Research Institute Observatory.
Report 3/40.

Absolute maximum in shade	...	98·0°F.
Absolute minimum in shade	...	63·0°F.
Mean maximum in shade	...	94·6°F.
Departure from normal	...	–0·2°F.
Mean minimum in shade	...	68·3°F.
Departure from normal	...	–1·4°F.
Total rainfall for the month	...	0·20″
Departure from normal	...	–0·60″
Heaviest fall in 24 hours	...	0·20″ on the 26th.
Total number of rainy days	...	1
Mean daily wind velocity	...	1·5 m. p. h.
Departure from normal	...	–1·2 m. p. h.
Mean humidity at 8 hours	...	64·1%
Departure from normal	...	–5·6%

The weather was dry during the month but for a light shower on the 26th. The rainfall, maximum and minimum temperatures, the mean humidity at 8 hours were all below normal, but temperatures rose to above normal at the end of the month.

P. V. R. & F. L. D

Association of the Upper Subordinates:— The Secretary of the Association of Upper Subordinate Officers of the Madras Agricultural Department writes under date 24th April 1940:— "The Annual general body meeting of the Association of the Upper Subordinate Officers of the Madras Agricultural Department will be held during the "College Day Week" in the month of July 1940. All members of the Association are invited to be present at the function".

Departmantal Notifications.

Gazette Notifications.

Appointments.

Sri T. Budhavidheya Rao Nayudu, Deputy Director of Agriculture, (on leave) Cuddapah is appointed to act as Superintendent, Livestock Research Station, Hosur, in Category 6, Class I, Madras Veterinary Service with effect from the date of taking charge.

Sri E. Kunhappa Nambiyar, Upper Subordinate, Agricultural section is appointed as officiating Assistant Director of Agriculture, St. Thomas Mount without prejudice to his leave.

Sri L. Narasimha Acharya, Agricultural Demonstrator, Chittoor is appointed to officiate as Assistant Director of Agriculture, St. Thomas Mount Vice No. (iii) on leave.

Transfers.

Name of officers.	From	To
Sri C. Ramaswami Nayudu,	Junior Lecturer in Agri. and Asst. Supdt., Central Farm, Coimbatore.	Offg Dy. Director of Agriculture, II Circle, Cuddapah.
,, M. Kanti Raj Nayudu,	Asst. D. A., St. Thomas Mount,	Junior Lecturer in Agri. and Asst. Supdt., Central Farm, Coimbatore.

Subordinate Service.

Promotions.

Sri P. Krishna Rao, Assistant in Millets Section, Coimbatore in IV grade (old) to III grade (old) on Rs. 200 to be provisionally substantive, with effect from 1st March 1940.

Sri V. Panduranga Rao, Assistant in Millets V. Grade (old) IV grade (old) on Rs. 120—10—170—to be provisionally substantive with effect from 1st March 1940.

Confirmations.

Janab Muhamad Obaidulla Shah Sahib, upper subordinate in the Madras Agricultural subordinate service is confirmed as Assistant in Paddy Section in the new III grade provisionally, with effect from 1st March 1940.

Transfers.

Name of officers.	From	To
Sri V. Kumaraswami,	F. M., A. R. S., Nandyal,	A. D., Kandukur.
,, L. Narasimhacharya,	Offg. Asst. D. A., St. Thomas Mount,	A. D., Chittoor.
,, G. Venkataramana,	A. D., Bapatla,	A. D., Vinukonda.
,, K. V. Reddi Naidu,	A. D., Vinukonda,	A. D., Bapatla.
,, M. Satyanarayana,	A. D., Pithapuram,	A. D., Yelamanchily.
,, K. Satyanarayanamurthy,	A. D,, Madanapalle,	A. D., Chittoor.
,, P. K. Natesa Ayyar.	Agri. Instructor, Warda Training School, Coimbatore.	A. D., Omalur.
,, R. Soundararajan,	Offg. F. M , A. R. S., Pattukottai,	Offg. Asst, in Mycology, Coimbatore.
,, James Colaco,	Offg. F. M. A. R. S., Nanjanad,	Offg. F. M., Sim's Park, Coonoor.

Leave.

Name of officers.	Period of leave.
Sri K. Rajabapaniah, F. M., A. R. S., Guntur.	Extension of l. a. p. for 2 days half average pay on m. c for 2 months and loss of pay for 1 month and 29 days from 30-3-40.
„ P. Kesavanunni Nambiar, A. D., Manantoddy.	L. a. p. on m. c. for 1 month from 12–4–40.
„ T. D. Easwara Ayyar, Asst. F. M., Sim's Park, Coonoor,	L. a. p. for 4 months from 1–4–1940,
„ M. K. Gopalan, A. D., Proddathur.	L. a p. for 1 month from 1--4–40.
„ K. Govindan Nambiar. A. D., Cheyyar.	L. a. p. on m. c. for 4 months from 28–3–40
„ P. Narayana Nair, A. D., Coimbatore.	L. a. p. for 30 days from 26–2–40,
„ R. Subramaniya Ayyar, Asst. A. D, Nannilam.	L. a. p, for 1 month from 21–3–40.
„ P. Subramaniam, Millet Asst., Nandyal.	L. a. p. for 2 months from 15–4–40.
Janab H. Soopi Hajee Sahib, Lower Subordinate.	Extension of l. a. p. for 1 month from 1–4–40,
Sri E. K. Govindan Nambiar, F. M., A. R. S., Taliparamba.	L. a. p. for 4 months from 15–4–40.
„ K. M. Jacob, A. D., (on leave).	Leave on half average pay on m, c. for 2 months from r. lief.
„ P. K. Kannan Nambiar. F. M., A. R. S., Nileshwar.	L. a. p. for 1 month from 1–4–40.
„ M. Kalimuthu, Teaching Asst. in Agri. Coimbatore.	L. a. p. for 2 months from 15–4–40.
„ C. S. Rajarathanam, Asst. A. D. in Mycology.	L a, p, for 1 month from 28–3–40.
Dr. R. Sankaran, Asst. Cotton, Coimbatore.	L. a. p. for 1 month from 27–3–40.
Sri G. Narasimhamurthi, F. M., A. R. S., Siruguppa.	L. a. p. for 30 days from 1–4–40.
„ K. Gurumurthi, A. D, Tobacco Market Committee, Guntur.	L. a. p. for 1 month from 13–3–40.
„ M. Gopala Unnithan, A. D., Tirupattur.	L. a. p. for 30 days from 17--4–40.
„ M. Vencoba Rao, Asst. in Cotton, B. T. S., Hagari.	L. a. p. for 1 month from 22–4–40.
„ S. Ramachandra Ayyar. A. D., Tinnevelly.	L. a. p. for 1 and ½ months from 25-4-40.
„ K. Rama Rao, A. D., Bellary.	L, a. p. for 2 months from 15–4–40.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the Quarter Ending 31st March 1940.

A. Books.

1. *Agriculture in the Twentieth Century.* Essays presented to Daniel Hall. (1939). 2. *Geomorphology.* Lobeck, A. K. (1939). 3. *Fertilizers in Modern Agriculture.* Russell, E. J. (1939). 4. *Proceedings of the Joint Meeting of the Standing Sub Committee on Field Experiments.* I. C. A. R. Pub. (1939). 5. *Research on Relationships of weather to crop yields.* Barle, C. F. and others. (1938). 6. *Indian Agricultural Statistics.* An Introductory Study. Thomas, P. J. (1939). 7. *The Origin of Indian corn and its Relations.* Wangelsdorf, P. C. and Reevas, R. C. (1939). 8. *Cotton Trade Markets.* Venkateswaran, S. (1939). 9. *Redges, Screens and Windbreaks.* Their uses, selections and care. Wyman, D. (1938). 10. *Cost of Production of Citrus Fruits.* Data from Studies in California and Florida. 1930-1937. Rawthern, S. N. (1938). 11. *Regulations in Respect of the Export of Citrus Fruit.* Union of South Africa Govt. Pub. (1938). 12. *The Citrus Industry of Palastine,* Haxon, N. W. (1938). 13. *The Weeds of South Africa.* Phillips, S. P. (1938). 14. *Report on the Marketing of Eggs in the Madras Presidency.* Gopalakrishna Raju, K. and Kunhi Kutty, M. P. (1939). 15. *Butterfat (ghee). Its composition etc.* Godbobe, N. W. and Sadagopal, N. W. (1939). 16. *Beekeeping for all,* Edwards, T. (1939). 17. *Animal Physiology.* Yapp, W. B. (1939). 18. *The Biology of cell surface.* Just, E. N. (1939). 19. *An Introduction to Botany.* Priestly, J. R. and Scott, L. I. (1938). 20. *Data on the Movements and Activities of Swarms of the Desert Locust in the northern and central parts of India from 1912-1931.* Govt. of India Pub. (1939). 21. *Principles of Mechanism.* Dyson, F. (1939). 22. *Modern Ideal Homes for India.* Deshpande, R. S. 23. *Principles of Economics.* 4th Edn. Revd. Vol. 1 Tanssig. F. W. (1939). 24. *Mathematical Analysis for Economists.* Allen, R. G. D. (1938). 25. *Indian Economics.* 6th Edn. Revd. Jathar, G. B. and Bai. S. G. (1939).,

B. Reports etc.

1. Madras Agricultural Department, Admininistration Report for 1938-39. 2. Madras Agricultural Department, Subordinate Officers Report for 1938—39. 3. Madras Agricultural Department, Detailed Report of the Agricultural Chemist, Entomologist and Mycologist 1938-39. 4. *India,* Imperial Council of Agricultural Research, Annual Report for 1938-39. 5. Bihar Agri. Dept. Annual Rep. 1937-38. 6. Punjab Agri. Dept. Annual Rep. 1937-38. 7. Burma Agri. Dept. Annual Rep. 1938-39. 8. Central Provinces and Berar Agri. Dept. Report on the Demonstration work in the western circle 1938-39. 9. Madras Department of Industries and Commerce—Administration Report 1938-39. 10. *England,* Rothamsted Exp. Stn. Annual Report for 1938. 11. Ceylon, Agricultural Department. Administration Report for 1938. 12. Minnesota, Agri. Experiment Station. Annual Report for 1937-38. 12. Storrs, Agricultural Experiment Station, Annual Report for 1937. 14. Texas, Agricultural Experiment Station. Annual Report, for 1938.

UNIVERSITY OF MADRAS

B. Sc. (Agriculture) Degree Examination, 1940,

FIRST EXAMINATION

AGRICULTURE

Monday, 1st April. 7 A. M. to 10 A. M.

Maximum: 60 marks

Answer Six questions. Questions 1 and 7 are compulsory.

1. State how air movements arise. What are the effects of the North-East Monsoon on dry and garden land farming in Coimbatore district [12 marks.]
2. Describe the methods which a farmer should adopt to secure the maximum benefits of the rainfall of the tract. [9 marks.]
3. Enumerate the agencies responsible for the formation of (*a*) laterite soils and (*b*) alluvial soils and briefly describe their action. [9 marks.]
4. In a farm located in a black soil tract a rainfall of 4 inches is received in the first week of August. What crops could be grown after that and what are the preparatory cultivations that should be done before sowing? [9 marks.]
5. State the effect of the following operations on alkaline soils under garden land conditions:—(*a*) Ploughing with Cooper 26 plough after 2 inches of rain. (*b*) Applying 20,000 lbs. of wild indigo crop. (*c*) Sowing cotton in lines one day after 1 inch of rain. What will be the effects of the above operations on red loamy soil under dry land conditions? [9 marks.]
6. Describe briefly with sketches a junior hoe. What are the uses to which a junior hoe can be put? [9 marks.]
7. Explain how a tobacco nursery should be raised? What operations should be carried out in the main field before tobacco seedlings are transplanted and how are the seedlings planted? [12 marks.]
8. Write short notes on:—(*a*) Cumulo-nimbus, (*b*) Soil pan, (*c*) Chain harrow, (*d*) Water spouts, (*e*) Coulter. [9 marks.]

BOTANY

Tuesday, 2nd April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six questions. Questions 3 and 6 are compulsory.

1. State exactly what part the cotyledon plays in the seedling stage in the following plants:—Lablab, Bengal gram, Castor, Maize, Date, Coconut. Draw figures to illustrate your answer. [9 marks.]
2. Mention the different modes of leaf arrangement seen in plants. What conclusions do you draw from them? [9 marks.]
3. Give a full account of the family Cucurbitaceae including therein (*a*) the morphology of the special parts; (*b*) histological peculiarities; (*c*) systematic position; and (*d*) economic importance of the family. [12 marks.]
4. Explain with diagrams the characteristic structures of the following and state where each may be found:—Cellenchyma, stone cells, aleurone layer, cystolith, lenticel. [9 marks.]
5. Show by means of clear sketches the structure and appearance of medullary rays as seen in the transverse, longitudinal and tangential sections of woody dicotyledonous stems. What purpose do the rays serve? [9 marks.]
6. Explain as fully as you can how water is absorbed from the soil by land plants, how and through what channels it is conducted and how it is utilised and disposed off. [12 marks.]

7. Write a short essay on the special methods of nutrition adopted by plants other than fungi giving examples. [9 marks.]

8. What is the composition of chlorophyll? How can it be extracted from leaves? What are its properties? [9 marks.]

CHEMISTRY

Wednesday, 3rd April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six questions. Questions 4 and 8 are compulsory

1. Starting from acetic acid how would you prepare Ethylamine? Enumerate its properties. Describe the test by which it is identified. [9 marks.]

2. What is Glycerol? Describe briefly the process of its manufacture on a commercial scale. Mention its chief properties. [9 marks.]

3. An organic substance of an unknown composition is given to you. Mention the steps involved in the process of determination of its constitution. [9 marks.]

4. 0·1511 gram of a substance gave 0·3057 carbon dioxide and 0·1409 gram of water. By the Kjeldal method 0·5622 grams required 6·16 c. c. s. of normal $H_2 SO_4$ for neutralization of ammonia. Find the empirical formula. If the vapour density of the substance is 87 what is the molecular formula of the substance?
1 c. c. of normal $H_2 SO_4$ = 0·014 grams of nitrogen. [12 marks.]

5. How is chloroform prepared? What are its chief properties? How would you proceed to determine its constitution? [9 marks.]

6. Explain the terms primary, secondary and tertiary as applied to alcohols and give two examples of each class. How do primary, secondary and tertiary alcohols differ from one another in their behaviour on oxidation? [9 marks.]

7. How would you convert Benzene into Aniline? Mention the chief properties of Aniline. [9 marke.]

8. How is naphthalene prepared on a commercial scale? What is the formula for naphthalene and upon what evidence is it based? [12 marks.]

ZOOLOGY

Thursday, 4th April. 7 A. M. to 10 A. M.

Maximum: 60 marks

Answer six questions. Questions 4 and 6 are compulsory.

1. Explain the terms 'tissues' and 'organs'. Describe the types of organization in animals. [9 marks.]

2. What is the purpose of a skeleton in an animal body? Describe the nature of the skeleton in the following forms:— (*a*) Sponge, (*b*) Precious coral, (*c*) Grasshopper, (*d*) Sea-urchin and (*e*) Frog. [9 marks.]

3. How do Nematodes differ from other worms? Describe briefly the structure and life-history of any Nematode parasite you have studied. [9 marks.]

4. State clearly the Zoological position of 'Aves'. Classify and give an account of the economic importance of the group. [12 marks.]

5. Give a comparative account of the structures connected with flight in an insect, a bird and a bat. [9 marks.]

6. 'The mouthparts of different insects vary very considerably.' Substantiate this statement giving suitable examples and sketches. [12 marks.]

7. Prepare a list of the nonhexapod invertebrate animals commonly found in a typical garden land stating the economic importance, if any, of each. [9 marks.]

8. Write short notes on:— (*a*) Hermit crab, (*b*) Amnion, (*c*) Glomerulus, (*d*) Archenteron, (*e*) Biogenetic law, (*f*) Hormones. [9 marks.]

SECOND EXAMINATION

AGRICULTURE. PLANT HUSBANDRY. I

Monday, 1st April 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six questions. Questions 1 and 7 are compulsory.

1. Name the manures and raw materials useful for preparing manures that are exported from India and give suggestions for making them available to Indian ryots at economic prices. [18 marks]

2. Differentiate between natural fertility and added fertility of a soil. What should be the understanding between landlords and their tenants in the maintenance of soil fertility ? [16 marks]

3. Name the green manure crops that are grown in different parts of the Presidency and discuss their suitability to different soils and cropping and other conditions prevailing in the tracts. [16 marks]

4. Name the important varieties of cotton that are grown in the Madras Presidency and the Agricultural stations devoted to their improvement. Name some of the improved strains popular in different tracts. [16 marks]

5. Write short notes on:— CO 419, G. E. B, 24, E. C. 593, A. S. 29, Co. 413, A. H. 25, Great Scot. [16 marks]

6. Why is the field register an important record in an Agricultural Research Station ? Give a sketch of the record showing the useful headings. [16 marks]

7. What do you understand by the expression 'unexhausted value of manures'? Name some manures which have such a value. State the manurial requirements of a garden land farm of 5 acres in the Coimbatore District in which one acre is allotted to vegetables. [18 marks]

8. Classify briefly the main soil types of the Madras Presidency. Describe in detail the soils of the Periyar irrigated tract. [16 marks.]

AGRICULTURE. PLANT HUSBANDRY. II

Tuesday, 2nd April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six questions. Questions 1 and 5 are compulsory.

1. Explain in detail how farm yard manure should be prepared in a wet-land village where the water table is 1 foot below ground level. What is the difference between 'long dung' and 'short dung'? Under what conditions should these be applied to give the best results ? [18 marks.]

2. What are the various causes which bring about soil erosion ? Describe briefly how erosion can be prevented on (*a*) Plain, (*b*) Hills. [16 marks.]

3. A ryot has an acre of low-lying land which is water logged and alkaline. State how the land could be brought into fertile condition so that valuable crops like Paddy, Sugarcane etc. could be grown. [16 marks.]

4. What are the various improvements that you can suggest in any one of the following :— (*a*) Coconut cultivation in sandy soil, (*b*) Sugarcane in wet land, (*c*) Karunganni cotton in black cotton soil ? [16 marks.]

5. A ryot owns 5 acres of good loamy soil with a good sweet water well which supplies abundant water throughout the year in a village which is mostly inhabited by Brahmins with a big temple which consumes plenty of flowers of various kinds. What rotation of crops would you suggest in order that he may be able to supply flowers and vegetables throughout the year ? [18 marks.]

6. Explain the effect of the following operations mentioned below :— (*a*) Ploughing twice with the country plough immediately after sowing cholam

on dry lands. (*b*) Double transplanting of paddy in wet lands. (*c*) Surface planting of pineapple suckers in the West Coast. [16 marks]

7. What are the conditions under which silage making is advantageous? escribe briefly how silage could be prepared out of an acre of ragi crop. [16 marks.]

8. Describe, with suitable diagrams, a Sindewahi furnace for boiling sugarcane juice and preparing jaggery. What are the advantages of using this type of furnace ? [16 marks]

AGRICULTURAL ENGINEERING

Maximum : 60 Marks.

Wednesday, 3rd April. 7 A. M. to 10 A. M.

Answer six questions only including 1 and 2 which are compulsory.

1. (a) A field *ABCD* is trapezoidal in shape; the parallel sides *AB* and *DC* measure 220 feet and 264 feet respectively; the side *AD* which is at right angles to *AB* measures 198 feet. Show by a dimensioned sketch how you would lay out 10 cent plots for experimental purposes.

(*b*) From the details furnished below of the prismatic compass survey of a four-sided field *KLMN*, evaluate its acreage correct to a cent :—

Station	Bearing	Distance in Links	Remarks
K	178°	612	*KL*
L	273°	1,053	*LM*
M	3°	625	*MN*
N	95°	1,030	*NK*

(12 marks)

2. (*a*) Define the methods of rating the powers of prime movers and describe with sketches how you would effect this by means of a transmission dynamometer.

(*b*) An oil engine is to be installed at Coimbatore for driving a centrifugal pump which has to discharge 500 gallons per minute against a total head of 66 feet. What is the B. H. P. of the engine you would order for the purpose assuming an efficiency of 60 per cent for the pump, and making an allowance of 10 per cent for overload and another 10 per cent for temperature and altitude ?

(*c*) Will a single cylinder engine answering to the following description suffice for the above purpose ?—Diameter of cylinder 8 inches; length of stroke 12 inches; mean effective pressure 100 lbs. per square inch; number of working strokes 145 per minute; mechanical efficiency 80 per cent. (12 marks)

3. Define the terms duty, efficiency and slip as applied to pumps and sketch in outline a Treble Ram Plunger Pump; one such is to be installed for delivering 50 gallons of water a minute against a total head of 300 feet. The pump is geared 4 to 1 and the speed of the pulley on the pump is 240 R. P. M. If the stroke is 6 inches, what should be the diameter of the barrels ?

If the diameter of the pulley on the pump is 30 inches calculate the width of belt required to drive this pump assuming an efficiency of 50 per cent and that one inch width of belt transmits 1 H. P. at 1000 R. P. M. (9 marks)

4. What are the methods usually adopted for the computation of (*a*) earthwork in cutting or banking and (*b*) capacity of a tank ?

How many gallons of water will a masonry storage reservoir of the following dimensions hold? Dimensions at top internally 50 feet long and 30 feet wide; the enclosing walls have a uniform internal batter of 1 in 4; the depth is 12 feet. (9 marks)

5. You are asked to prepare plans and estimates for a new road to connect a projected farm with the nearest local fund road a mile off. Describe the processes involved both in the field and in the drawing office.

Sketch a typical cross section with the following data:— Existing ground level 45'00 ; H. F. L. (1924) 48'00 ; width of formation 12 feet; soil gravelly; land cheap. Mark the total width of land to be acquired. (9 marks)

6. What are the laws of fluid friction ? State with reasons the cross section usually given to masonry irrigation channels. Design one such for carrying 2 cusecs at a velocity of 4 feet per second. Take $c=96$. (9 marks)

7. Describe with sketches *either* of the following farm machines :—

(*a*) a power driven sugarcane mill with 3 rollers,

or

(*b*) a power driven double roller cotton gin. (9 marks)

8. Write short notes on :– (*a*) working steam expansively, (*b*) carburettor of a petrol engine, (*c*) impellors of turbine pumps, (*d*) soft centre steel, (*e*) designing foundations for buildings in black cotton soils. (9 marks)

AGRICULTURAL ZOOLOGY

Thursday, 4th April. 7 A. M. to 10 A. M.

Maximum: 60 marks

Answer six questions. Questions 2 and 3 are compulsory.

1. Give an account of lac cultivation in India. State briefly the important points to be observed in starting lac culture (9 marks)

2 Describe the major pests of groundnut and coconut palm in South India under the following heads ;-- (*a*) Name of the pest and its family. (*b*) Distribution. (*c*) Nature and extent of damage. (*d*) Life-history. (*e*) Alternate host plants. (*f*) Control methods. (12 marks)

3. Discuss the scope of insecticidal methods of pest control under South Indian conditions. (12 marks)

4. Give instances of successful biological control of insect pests and weeds in South India. What are the factors for success in biological control ? (9 marks)

5. Mention the important characters of the orders Thysanoptera and Aphaniptera. State the economic importance of the two orders. (9 marks)

6. Tropisms will undoubtedly in the future be put to practical use in economic entomology. Discuss this statement. (9 marks)

7. Describe briefly the life-history and habits of (*a*) Paddy grasshopper, (*b*) Fruit-sucking moth, (*e*) Brinjal beetle. Show how a study of these is helpful in devising suitable control methods. (9 marks)

8. Write short notes on :— (*a*) pebrine, (*b*) trap crops, (*c*) eelworms, (*d*) psychidae, (*e*) sawflies. (9 marks)

ANIMAL HYGIENE

Friday, 5th April. 7 A. M. to 10 A. M.

Maximum : 60 marks.

Answer six questions. Questions 2 and 4 are compulsory.

1. Describe briefly the pelvis of a bullock and compare it with that of a cow. [9 marks.]

2. Draw a diagram of the alimentary canal in situ of a fowl. Name its parts and state the use of each part. What is the spleen ? Where is it situated ? Describe its function. [12 marks.]

3. Write out a prescription for a case of simple fever in a cow and state how the drugs prescribed behave in that particular case. How do you nurse this case ? [9 marks.]

4. What do you understand by epizootic and enzootic diseases ? Give an example of each. What are the means by which these diseases are conveyed to animals ? What are the general principles to be adopted to prevent the spread of infection ? [12 marks.]

5. What is yoke-gall ? Name the different kinds of yoke-galls. Explain how these are caused in working cattle and describe the treatment of any of them. What precautions would you take to prevent the occurrence of such galls ? [9 marks.]

6. Name some common ailments that are incidental to calves soon after birth and state how you would manage any two such cases. [9 marks.]

7. Give the causes and treatments of the following :— (*a*) watery eyes in a bullock, (*b*) occlusion of the teat canal in a she-goat, (*c*) roup in chickens. [9 marks.]

8. Write what you know about abortion in cows. [9 marks.]

FINAL EXAMINATION

AGRICULTURE—ECONOMICS AND FARM MANAGEMENT

Tuesday, 9th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six questions. Questions 1 and 6 are compulsory.

1. What is meant by an economic holding ? A family of five adult members (two males and three females) with a pair of bullocks and sufficient capital want you to select an economic holding on lease in the garden land area in Salem District. Give details of the area, cropping and equipment for the holding selected by you. (18 marks)

2. It costs roughly Rs. 250 to raise a sugarcane crop of 30 tons per acre in a locality where there are independant farmers with 10 acres and small working farmers with 1 acre of sugarcane. A sugar factory offers Rs. 12 per ton of cane and market price of jaggery is Rs. 30 per candy of 500 lbs. What are your suggestions for the disposal of the crops raised by these two classes of farmers ? (16 marks)

3. What is your opinion on the following prevailing systems with a view to advance agricultural progress :— (*a*) annual *versus* a permanent lease, (*b*) share *versus* a fixed money rent, (*c*) payment of wages in kind *versus* cash ? (16 marks)

4. Suggest any local agricultural problem requiring investigation and draw up a scheme for conducting experiments to solve the problem. (16 marks)

5. What are the advantages of a regulated market ? Have you any advice to offer to ryots in preparing their cotton and groundnut produce for sale in such a market ? (16 marks)

6. What are your views regarding the establishment of farming colonies as a solution to the unemployment problem ? Would you work such colonies on a co-operative or an individual basis ? Give reasons for your answer. (18 marks)

7. Compare and contrast the economic life of an ordinary black soil ryot of the Ceded Districts with that of a similar ryot in the Tinnevelly area. By how much would their annual incomes differ if each owned 50 acres of dry black soil ? (16 marks)

8. Write short notes on :— (*a*) Economic rent, (*b*) Non-credit societies, (*c*) Market standards, (*d*) Money crops, (*e*) Crop loans. (16 marks)

AGRICULTURE—ANIMAL HUSBANDRY

Wednesday, 10th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six questions. Questions 1 and 6 are compulsory.

1. The District Board, Coimbatore, has provided Scinde breeding bulls with good pedigrees and high reputation for milking quality for the towns of Coimbatore and Erode. Explain the objects for doing so and state how far they have succeeded in their aims. Estimate the cost of housing, feeding adequately and maintaining a breeding bull for one year. (18 marks)

2. Criticise the practice of communal grazing. What alternative suggestions could you make to ryots who own large herds of cattle without adequate grazing areas ? (16 marks.)

3. Do you consider mixed farming suitable for the conditions prevailing in this Presidency ? Give reasons to substantiate your views. What part could sheep rearing play in mixed farming ? (16 marks.)

4. Describe in detail any cream separator which you have worked. What are the advantages of using a separator ? (16 marks.)

5. What are the points for judging good butter ? Why is butter salted ? (16 marks.)

6. A Producers' Co-operative Supply Union wishes to supply 1,000 lbs. of milk daily in a town. Calculate the cost of the equipment, establishment, transport facilities and cost of milk basing the cost on existing rates at Coimbatore. Which would you consider more economical (*a*) to own the required number of cows and run the show, (*b*) to buy milk from outside and supply ? (18 marks.)

7. Explain the principles underlying the feeding of :—(*a*) a work bullock-(*b*) one year old calf, (*c*) cow yielding 20 lbs. of milk per day. Suggest suitable rations and estimate the cost of feeding for one month a heard consisting of one pair Khangayam bullocks, two dry Scinde cows and five weaned calves under one year old ? (16 marks.)

8. Write short notes on :—(*a*) Telgony, (*b*) Compensative mating. (*c*) Artifical insemination, (*d*) Line breeding. (16 marks.)

AGRICULTURAL BOTANY, I

Thursday, 11th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six questions. Questions 3 and 6 are compulsory.

1. Enunciate two main theories about the origin of cultivated plants species and discuss their relative merits. (16 marks.)

2. Enumerate, mentioning the botanical names and families of the chief root crops grown in South India. Describe botanically the portion of the plant used for food or other purposes and explain the method of propogating the plants. (16 marks.)

3. Describe the functions of green manure crops in the Agricultural economy of this province. Name and describe botanically four green manure plants with which you are familiar making special mention of their merits and demerits (18 marks.)

4. Plan out a scheme for the improvement of any two of the following crops by the use of genetic methods :—(*a*) Ragi, (*b*) Chilli, (*c*) Pepper. (16 marks.)

5 Describe with the aid of diagrams the floral anatomy of the following crop plants and mention their methods of pollination :—(*a*) Sorghum, (*b*) Papaya (*c*) Mango, (*d*) Castor. (16 marks.)

6. Classify the genus 'Citrus' according to species and varieties, Mention the botanical and other characters by which you would distinguish them. (18 marks.)

7. What is the significance of (*a*) pruning and (*b*) top grafting in horticultural practice ? Mention one example each in which the operations can be used to advantage and describe with diagrams how the operations are carried out. (16 marks)

8. Write short notes on :— Hetero-zygote, polyploidy, lethal factor, chimera, transgressive variation, polyembryony, xerophyte. (16 marks.)

AGRICULTURAL BOTANY. II

Friday 12th April. 7 A. M. to 10 A. M.

Maximum 100 marks.

Answer six questions. Questions 3 and 5 are compulsory

1. Give an account of the evolution of sex in Algae. Illustrate your answer with examples and descriptive diagrams. (16 marks.)

2. What do you understand by 'Alternation of generations'? Compare this phenomenon in Ferns with that of Angiosperms. (16 marks)

3. What are 'chromosomes'? Give a brief account of the chromosome theory of heredity (18 marks.)

4. In 'Datura', purple flower is dominant over white and spiny fruits over smooth. A purple smooth Datura crossed with a white spiny one gives 320 purple spiny and 312 purple smooth plants. If these two types of offspring are bred together, what will their offspring be like both as to appearance and gentotypes? (16 marks.)

5. What is a 'virus' disease? Mention some important crop plants affected by this disease. Describe the typical symptoms in each case and mention the various methods adopted to keep these diseases under control, (18 marks.)

6. Mention one of the most important fungus diseases affecting each of the undermentioned crops, giving typical symptoms of each, mode of spread and the control methods adopted in each case:— (*a*) Paddy, (*b*) Groundnut (*c*) Arecanut. (16 marks.)

7. How do the fungus diseases of plants get spread from one locality to another and from one country to another? Describe the various methods followed to prevent such a spread. (16 marks.)

8. What are 'fungicides'? Mention the different kinds describing the mode of application of each and giving instances where each can be applied. (16 marks)

AGRICULTURAL CHEMISTRY. I

Monday, 15th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six questions. Questions 1 and 3 are compulsory.

1. What are the constituents of a soil on which you would base your opinion of its fertility? Describe a reliable method of estimating the total and available phosphoric acid contents of a soil. (18 marks.)

2. Give a brief account of the agencies in a soil responsible for the fixation of atmospheric nitrogen. Is there any increase in soil nitrogen when molasses are applied to it? How is the action of molasses explained? (16 marks.)

3. Write a short note on the nature and formation of alkaline soils. Describe the methods of reclaiming such soils, also the measures which can be taken in an irrigation tract to prevent their formation. (18 marks)

4. What do you understand by the term 'Water holding capacity' of a soil? Discuss the relationship between such a capacity and the amounts of silt, clay and organic matter contained in a soil. (16 marks.)

5. Discuss the importance of a soil survey in general and also with reference to a tract proposed to be brought under irrigation. (16 marks.)

6. Discuss the relative importance of farm yard manure and artificial manures in increasing agricultural production. (16 marks.)

7. Discuss the relative merits of the heap, pit and box system of making farm yard manure. (16 marks.)

8. Write a short note on the acidity of soils. (16 marks.)

AGRICULTURAL CHEMISTRY. II

Tuesday, 16th April. 7 A. M. to 10 A. M.

Maximum: 100 marks

Answer six questions. Questions 2 and 5 are compulsory

1. What is meant by Digestibility Cofficient? Describe briefly how you would determine the digestibility coefficient of a feed with cattle. How is the digestibility coefficient of use in evaluating the quality of a feed? (16 marks.)

2. What is the importance of mineral matter in the nutrition of growing calves and milch cows? What is mineral deficiency due to, what are its effects and how would you correct it? (18 marks.)

3. Give a short account of the fate of protein of food in the herbivorous animal from the time it enters the alimentary tract till absorption. (16 marks.)

4. Write short notes on:—(*a*) Photosynthesis, (*b*) Vitamins in cattle nutrition, (*c*) Cyanogenetic glucosides, (*d*) Green fodder in relation to milk yield. (16 marks.)

5. What are enzymes? What is their main function in plant metabolism? Describe their role in the malting of cereals. (18 marks.)

6. What are the chief groups of vegetable oils? Describe their chief chemical properties, mode of occurrence and commercial uses. (16 marks.)

7. Compare the chemical composition of Cow's milk with that of Buffaloe's milk. How would you determine, by simple tests whether a given sample of milk is adulterated or not? (16 marks.)

8. What are the chief groups of bacteria which are present in contaminated milk? How would you control Dairy operations from the time of milking till the milk is marketed to avoid contamination with these bacteria? (16 marks.)

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EDITORIAL

The Indian Sugar Industry. Owing to the introduction of new varieties of canes evolved at the Coimbatore Station and the fillip given to the Industry by the protective tarriff on sugar imports, the Indian Sugar Industry has been making steady progess during the last two decades. India has now reached a stage, when she can not only supply all her own requirements, but has considerable quantities of exportable surplus of refined sugar left. But in recent years, the restriction placed on the industry, by the imposition of an excise duty and the increase in railway freights together with the ban on exports of sugar by sea, have acted as severe handicaps and the profits accruing to the growers and the manufacturers are steadily falling. While it must be admitted that the excise duty and the increase in railway freight are but just legitimate demands on a prosperous industry, we are of opinion that the ban on exports which acts as a severe handicap on the industry should be forthwith removed. The sugar manufacturers in India have been for some time past vigorously agitating for the removal of this ban, and from the figures furnished by them, it would appear that India produces annually 14,00,000 tons of refined sugar, while the total consumption in the country is only 10,50,000, tons. The surplus quantity of 350,000 tons, has either to be distributed in India by increasing the per capita consumption, or be exported to overseas markets. There will be considerable objection to the former course owing to the adverse effect it will have on prices and on the cottage industry of jaggery manufacture. Hence, the removal of ban on export of sugar by sea is the only course which will meet with the approval of the agriculturist. Besides this, at least till the cessation of the war, a ban should be imposed on imports by sea, in order that the world's surplus sugar is not dumped in the Indian markets. Having said this for the sugar manufacturers, we are constrained to remind them that they have not always been fair to the cane grower, and but for government intervention would have often deprived him of his legitimate share of the profits. We would urge them to remember that the interests of the cultivator are closely linked with theirs, and while they are reluctant to share their excess profits with him, they should not be eager to shift their losses on to his shoulders.

The War. As we go to press we learn that the barbaric hordes of a mechanised army under the guidance of a dictator who for sheer ruthlessness and evilmindedness would appear to surpass Attilla the Hun, are invading one helpless country after another, leaving in their trail dire destruction and disaster. Neither ethical values nor the fear for the future of the human race, would seem to deter this invader from his evil course, and it is to the eternal glory of Great Britain and France that they have gallantly and unselfishly stood up against this monster, and in this hour of grave peril let all men silently send up their fervant prayers to almighty God that the world may yet be rendered safe for all peace loving and rightminded men.

A Plea for a Protective Duty on Rice

By I. S. KUTTALINGAM PILLAI.

Member, Rice Committee, I. C. A. R.

Introduction. Rice is a crop of an all-India importance. Its cultivation is wide and important in the Provinces of Bengal, Madras, Bihar, and Assam. With its 72 million acres, India has the largest area under rice among the countries of the world. Her outturn of rice is a little over half of what is produced in the world and four-seventh of the production of Asia, the most important rice producing continent in the world. Out of the world production of 830,000 quintals of rice in 1935–6, Asia alone produced 772,000 quintals of which 442,880 quintals formed the share of India and Burma together. Burma alone produced only a sixth of this amount. These figures clearly show the importance of India in the production of rice as well as the relatively minor contribution of Burma to the world output.

An anomaly. In spite of the fact that India tops the list in the matter of both output and acreage under rice, it is pathetic but true that she has no voice in the determination of the world price-level of rice. This is due to Burma's proportionately vast export surplus of rice. Notwithstanding India's pre-eminent position as a rice-producer, she is suffering from a deficit supply which meets only about 92 % of her national demands. This shortage is made up by imports from abroad, mainly from Burma. In recent years, after the commencement of the era of subsidised rice production in some European countries and the expansion of rice cultivation in both the American continents, the over-sea markets of Burma have dwindled considerably. Consequently Burma has come to look upon India as the main market for her export surplus. It is true that Burma helps India by making up her shortage. But in doing so, she depresses the price-level in this country to such an extent that the rice producers are hard hit and as a consequence the rural economy of the rice-growing provinces is disturbed to an alarming extent. Statistics are not wanting to prove that the competition of Burma in Indian markets with the home producers has sagged the price to a level that is unremunerative to the majority of rice-growers in this country. It may be argued that if rice-cultivation is unremunerative, there would be a change over and more economic, if not lucrative crops would be substituted. This has not happened owing to two reasons. Firstly most of the lands under rice cannot be utilized for any other cultivation. Secondly custom, the curse of peasant economy, keeps the peasants in the uneconomic groove of cultivating what their forefathers had done for several generations before them. Our rice growers have persisted in raising rice crops against severe odds. They have to contend against the low cost of production of rice in the fertile Irravady delta and against the inelastic production of an export surplus in Burma. While being thankful to Burma for eliminating scarcity in India, it is incumbent upon us to study the attitude of Burma

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towards Indian markets. Burma would fain sell her rice in foreign markets but owing to the closure of European markets, she naturally turns toward India as the last resort. She has come to count on India as a permanent market for her superfluous rice. Her present position is that she should sell her rice in India or have it rot in her fields. Although she does not sell at a price in India below the home price and thus avoid the indictment of dumping in the technical sense, her act has got all the unsavoury features of dumping in excelsis because the price of rice in India drops immediately a Rangoon steamer is sighted from the Indian coast. This is but as it should be: as every tyro in Economics knows that the price is governed by the marginal supply; the very low marginal cost of production of Burmese rice drags down the price-level in India. In discussing it in an academic manner it sounds right; but from the standpoint of the poor cultivator in India, this inexorable law whisks away the little profit he would have been dreaming about all the months since he planted the seedlings. Worse still in many cases, this lands him in severe loss. The rice grower in India is thus frustrated in his attempt to make an honest living by agriculture. The nature of his land and his social conditions positively rule out any possibility of his taking to commercial crops. Under such circumstances immediate relief is necessary, if he should be saved. India cannot also afford to be looking on unconcernedly at the process of her rice fields being turned to commercial farming ceaselessly. Already there is a shortage of rice and if this process is to operate for a decade, the gap between supply and demand of rice will be wider. Free import of rice from Burma may obviate scarcity today, but how can this continue? The import of 1·8 million tons of rice appears only to be a thin end of a wedge; and in course of time, India, primarily an agricultural country, may become dependant upon foreign countries for her staple food!

The need for a Protective duty. In order to remedy this state of affairs, it is not suggested that the import of rice should be completely prohibited from Burma. What is suggested is the imposition of duty, not heavy and prohibitive, but mild and sufficient, to safeguard the interests of the Indian rice-growers without injuring the consumers' interests. The object of this duty is to raise the price of rice to a remunerative level and to encourage Indian growers to produce sufficient to meet the national demand. One should agree with the proposition that high price is swallowed up in the long run by high costs. But it should be the endeavour of the Government to take this tide of higher prices to carry out the following programme in its entirety or in an amended form for increasing the output and make India self-sufficient regarding rice.

Increasing Indian Production. Increase of output should be achieved by increasing the yield from each acre. At present about 72,000,000 acres produce 25 million tons of rice meeting about 92 % of the country's demand. The object to be aimed at is to secure a 10 % increase in output. In India the yield per acre is estimated at 870 lbs. of rice. Spain, Italy and

Japan produce respectively nine, five and four times as much as India. Even if we cannot aspire for such a phenomenal increase in yield without radically altering the system of land tenure, methods of cultivation etc., it is possible to expect a 10 % to 15 % increase by the use of selected and pure seeds. " An increase in yield of at least 10% by the growing of strains obtained by simple selection in local varieties has been proved to be a possibility as the work of the Rice Botanists in the various provinces would show "—(Madras Government's note). The yield is today considerably affected by the C 3 seeds the peasants are using The grains in the same field do not mature simultaneously and the peasant has to harvest when more than half has ripened. If he waits for all the grains to ripen, he has to face the loss of early ripened grains due to shedding. Selected and pure seeds will eliminate this cause of low yield.

The problem of Seed supply. The next question to consider is how to supply such seeds to all peasants. It should not be difficult to find in every village enthusiastic land-holders who would cultivate a few acres of their lands according to the instructions and under the guidance of Agricultural Demonstrators. From these ' seed forms ' it is quite possible to supply the selected and pure seeds. This may be accomplished by means of a five-year plan. Along with the distribution of seeds, if efficient marketing methods on co-operative lines are devised and put into practice, the middlemen's and moneylenders' toll would be avoided and *pro tanto*, the peasants' profits increased.

Protection—a pre-requisite for improvement. It is not possible to carry out such a five-year plan at present, when the price has sagged down to an unremunerative level. It is only under the favourable auspices of an import duty that the five-year plan will be successful. Under the spell of the prolonged depression and low price level, the rice growers are languishing thoroughly demoralised. An import duty causing the price to look up a little, is indispensable to undertake any measure for improving rice production.

Consumers' interests. Now we turn to the effects of an import duty on the consumers. It is argued that the rise in price will detrimentally affect them. Firstly the price will not rise unduly high ; for a steep rise will induce Burmese exporters to pay the duty and sell rice in Indian markets. This possibility of an import duty-laden rice will act as a safety valve against arbitrary raising of price by local producers in times of scarcity. Secondly the small rise to be expected legitimately of an import duty will not be wholly appropriated by the rice growers. The advantages of this rise will be partially transmitted to the landless agricultural labourers who have recently become the object of sympathy with certain schools of opinion. It is often forgotten that prosperity of this class of agricultural proletariat is inextricably entwined with the lot of the landholders. The low price of rice has hit the rice growers and they have held up improvements of their lands

and expansion of cultivation and postponed even very necessary annual repairs of bunds and balks, thus reducing the volume of work available to the agricultural workers. All these restrictions to available work will be relaxed as soon as the prices look up, as a result of the change in the psychology of the landholders. These workers at present suffer from the lack of an alternative urban demand for their labour and therefore remain in involuntary idleness.

Possible Burmese reaction. Regarding the possibility of Burmese retaliation, her favourable balance of trade rules it out of practical politics. Besides Burma's oversea markets have shrunk without any hope of being recaptured. So she has to sell her rice in India, not at her own terms but at India's terms. India should not hesitate to dictate her own terms. When the spectre of economic nationalism is ravaging the whole outside world, if India remains wedded to moribund *laissez-faire* theories, it may be consistent with her ancient traditions of toleration but the policy is economically unsound and even dangerous. None can deny India's natural advantages for rice growing. If owing to public or private callousness, an ostrich-like policy is pursued and her natural resources are not utilized to their maximum capacity, more alert, vigorous and self-confident countries will take advantage of the situation and flood the free Indian market with their surplus rice which would have lost all the other markets in the world. 'When you are in Rome be a Roman,' is an old adage. This advice to the individual is no less apposite to nations. When there is economic nationalism everywhere, it is folly for any single country to be otherwise. Behave as others do, is hardly less applicable to nations than to individuals. In the case of India, protection of rice-growing is not like supporting an unsuitable industry on stilts but granting to an industry its desert that is long over-due. It is not essentially a military but an economic consideration that weighs in the matter of protection. Has not the duty on wheat improved the conditions of the wheat-growers in the Punjab ? Again the Indian sugar-cane growers could not have achieved the present degree of prosperity but for protection. What rice-growers demand is nothing more than bare justice to their cause. When wheat and sugar were protected, the argument that they would be of sectional advantage was, if raised, hushed into silence. Wheat is as widely consumed in the wheat growing provinces as rice in rice growing provinces, and sugar is consumed in all the provinces. The interests of the consumers were overridden for the time being for the sake of the ultimate good. In a similar spirit why should not rice, the staple industry of more than half of India, be protected. Such a protection is quite in consonance with the policy of discriminate protection, recommended by the Fiscal Commission and pursued for the last one decade and more.

Summary and Conclusions. Rice is one of the major crops of India. The price level, since the depression when it reached the nadir, has not risen to a remunerative level. The continued depressed level of prices has depressed the minds of the rice-growers. Unless some immediate remedy

is applied to raise the price level, the rice-growers will be completely beaten hollow by the Burmese competitors and the acreage under rice instead of remaining stationary, will decrease. That will lead to a wider gap between supply and demand, which will be aggravated by the growth of population. Although any increase in the rice area is not imperative the yield per acre should be increased by scientific methods of cultivation. The rice grower at present is paralysed by the deplorably low price level. It is impossible to stimulate him into activity without an import duty on foreign rice. It may be argued that it is an artificial hampering of the free operation of economic forces. An incision of a carbuncle is an artificial meddling but necessary to save the patient. So also protection is necessary to save the rice grower. Without convincing him by the concrete rise in the price level, any amount of research, dissemination of scientific knowledge etc. will be futile. Hence the urgency for an import duty. Procrastination, the sin of all democratic governments, will rob the Indian rice grower of the good that an import duty can do for him. The only practicable solution lies in the granting of protection to rice without any delay. Inaction at this stage will slide the rice growers into the slough of despondency from which it will be hard to rescue them.

Cotton linings for irrigation ditches may be the new way to make a dent in the surplus cotton stock piles of the South, it was suggested to the National Reclamation Association meeting at Denver. The new utilisation of cotton supplements the use of cotton fabrics as a binder for secondary highways and airport runways. W. H. Robinson manager of an irrigation district in Idaho, described how a section of an irrigation canal was lined with a mixture of asphalt and gravel backed by heavy cotton fabric. Water losses in this section, which formely ran from 20 per cent to 30 per cent, have now been cut to about one and one half percent. The standard method of lining irrigation canals is with concrete, which pays for itself despite high cost. The cotton-gravel-ashpalt liner is cheaper.

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Introduction of sugarcane varieties in the Presidency.

By M. KANTI RAJ, M. A., B. Sc. (Edin.)

Madras Agricultural Department.

Introduction. Sugarcane is one of the important 'cash' crops, grown on a fairly extensive scale, in some of the districts of the Presidency. The crop received attention, even in the early years of the Agricultural Department, when it was under the control of the Board of Revenue. During the years 1895 to 1897, the area under this crop in the Godavari district, declined, due to the ravage of "Red-rot" (*Colletotrichum falcatum*). It was in 1898, that an Economic Botanist, the late Dr. Barber, was appointed to investigate the disease and overcome it, if possible. In 1901, a small extent of land was leased in the Godavari district, to grow different canes and select therefrom the resistant types. It was felt that this was the most practical method to deal with the situation. This resulted in the establishment of Agricultural Research Station, Samalkot, which was opened in 1902, for this purpose. This crop, as the facts indicate, received attention, even long before the Department became an independent one, as it did in 1906, the year in which a whole time Director of Agriculture was appointed.

Government enterprise. The introduction of varieties from foreign countries, took place, long before the appointment of the Economic Botanist. The available records indicate, that the throwing open of the English market in 1835, was the first occasion when attention was paid to this crop. The credit goes to Dr. Robert Wright, who was then the Secretary of the Agri-Horticultural Society, Madras. He was the first person to take initiative in the matter, by addressing a letter in November 1836, to the Government of Madras, indicating the possibilities of improving the crop, with the object of manufacturing sugar and exporting the commodity to the English market. Acting on the advice of Dr. Wright, the local Government, requested the Government of Mauritius, in December 1836, to send a consignment of a few cuttings of sugarcane cultivated in that island. It took two years, for the request to be complied with and the consignment arrived in 1838 – over hundred years ago.

The entire consignment was placed in charge of Dr. Wright and, further, a subsidy was given by the local Government to meet the cost of multiplication and distribution of setts to different parts of the Presidency. The distribution was, in 1839, to the Collectors of each district for trial. In 1840, it is stated that demand for seed material was so heavy that the Society was not able to meet them. The local Government, till 1850, continued to support the scheme for distribution of seed material and even offered to remit assessment on lands, utilised for the multiplication of seed material It was these canes, from Mauritius, that first solved the disease problem. in the Godavari district. Some of these are still in cultivation both in our Presidency and in the adjoining Bombay Presidency.

Private enterprise. In addition to these steps, taken by the local Government, certain varieties from foreign countries were also introduced through private enterprise, as indicated below :—

(a) In 1844, sugar factories were established at Aska (Ganjam District), Chittivalsa (Vizagapatam District) and near Rajahmundry (Godavari District) by some enterprising European businessmen. They had some share in the introduction of varieties from foreign countries, presumably, with the idea of getting better varieties of cane for their factories.

(b) Some foreign varieties, much in favour with the ryots of the Bombay Presidency, were also imported, by ryots of the bordering districts of South Kanara and Bellary.

(c) The indentured labour coolies, returning from foreign countries such as British Guiana, West Indies, South Africa, Natal, etc., were also responsible, to a certain extent, in the introduction of varieties.

Other varieties. Besides Mauritius, varieties were imported from Barbados, Demarara, Queensland, Fiji and Java. They have become so common with the ryots now, that their original names have been replaced by names in local Indian languages. The following instances will bear truth of this statement :—

(i) *Hathakabbu* of Bellary District, *Tella cheruku* of Chittoor District, *Poovan* of Coimbatore District, *Keli* of Godavari District and *Palabontha* of Vizagapatam District are the names given in different localities, for one and the same foreign variety.

(ii) *Natalam, Patta Karumbu, Nama Karumbu, Namalu, Desari, Saralu Yerrapattavali* are the names given in different localities, for one and the same foreign variety—Striped Mauritius.

(iii) *Vellai* (otherwise known as Seemai) of Coimbatore District, *Yerra* (Red Mauritius), *Arati Poovu* (Purple Mauritius), *Panni Karumbu* and Fiji B are some instances where foreign varieties have lost their original names. The present position is, that for statistical purposes, with the exception of a few—J. 247 and Fiji B (Badila)—all these foreign varieties are reckoned as indigenous. The main object of this note, is to correct this misnomer.

Conclusion. In this Presidency, at present, these foreign varieties have completely replaced the indigenous variety. Since 1932, these foreign varieties are being gradually replaced by varieties evolved at the Imperial Cane Breeding Station, Coimbatore. The expression "Improved variety" has come to be synonymous with the "Coimbatore canes". Judging from the rate of progress made, it is not too much to expect, that in the course of about five to ten years, the whole area under sugarcane in the Presidency will be under "Coimbatore varieties".

Tea Cultivation in South India.*

By E. A. STONE

Manager, Gajam Mudi Estate, Anamalais.

(Continued from Vol. XXVII Page 161)

Cultivation in Tea. Weeding continues the whole year round. At certain times of the year, in the good growing weather before and after the monsoons, weeds grow very fast; at these times a seed can grow into a full size plant which in its turn is producing seed in about 5 weeks or less. During the heavy rains the growth of weeds is less rapid, but weeds pulled out and left on the ground will continue to grow and flower. It is therefore necessary to collect them into big heaps which should be turned over after a few weeks to avoid spreading of seeds. In the dry weather there is little need of weeding, once the estates have been thoroughly cleaned up from the previous rains. It is usual for an estate to have seven, eight or nine complete rounds of weeding in a year. During the heavy rains only hand-weeding is done to avoid loosening the top soil too much and thereby losing it. With the hand weeders a few coolies are sent with weeding forks or *kokras* to clean up any grassy patches, but these being usually found in flat places forking will not cause much erosion. After the heavy rains are finished, clean weeding is started, using *kokras*. Fields which have recently been pruned and so have less cover from the tea will be the weediest and need cleaning up first. By the end of January an estate is usually quite clean. 'Kokra weeding' is then continued until heavy and regular rain is falling i. e. about May.

Weeds are mostly grasses and members of the family Compositae. Woody shrubs and trees seeded from nearby jungles have to be rooted out, and every time a field is pruned the ferns growing close under the tea bushes should be carefully eradicated (not that ferns should be left at other times; it is easiest to get them out completely at pruning time). At the same time as weeding a field, all flowering weeds in its swamps should be sickled, and roads and drains cleaned. During the heavy rains, roads and drains need special attention for keeping clean if blockages and washouts with resultant loss of top soil are to be avoided, and culverts especially should be regularly inspected.

This question of soil erosion occupies the planters' mind a lot, and all kinds of devices are used to combat it. As mentioned, only hand weeding is done during the heavy rains, and all small weeds are left. Where there is plenty of loose stone, contour walls $1\frac{1}{2}' \times 1\frac{1}{2}'$ are built which by holding up the soil, form terraces. Contour trenches are dug for breaking the wash, but these cause a lot of damage to the tea roots. Another good plan is to

* [We apologise to our readers for the long gap between the third and fourth instalments of this series. The author's absence on leave out of India and the outbreak of the war have caused an unavoidable delay. *Ed. M. A. J.*]

build walls all round the bottom edges of fields so separating them from the swamps and raising the field level at the bottom above the swamp, where previously continual scraping away of grass growing from the swamp up into the tea has exposed the tea roots. This helps also to keep the swamp drains clear, and where swamps are used for cattle grazing, the walls assist in keeping the cattle out of the tea-fields.

Growing plants for green manure helps, especially of the spreading variety, but these I will mention later. Contours of Paspalam or other non-seeding grass may be grown, but these tend to encourage field rats which feed on the roots.

Antimalarial work. Malaria is prevalent in most hill districts of South India, and this work is essential. Swampy areas have to be drained correctly and blockages of rock blasted out to get even flow of water in the drains. These drains and all stream and river edges must be kept clear of grass and vegetation in the mosquito breeding months (before and after rains), and oiled with *malariol* weekly.

Forking. This work is usually done after heavy rains are over and before the dry weather, to break up the capillaries in the soil and conserve the moisture, as well as for aerating the soil and increasing the bacterial action in it. Most of my readers will know more about this subject than I, so I will pass on quickly, only pausing to say that in forking, care has to be taken not to damage the tea roots or expose them on the surface. 'Envelope forking' where the earth is not turned over, but merely loosened and pushed forward is the usual method employed.

Control of Shade. Tea likes a thin dappled shade, and for this, silver oak (*Grevillea robusta*) trees are planted in rows (previously mentioned) about every 12 rows of tea apart. These trees if allowed to grow on without any form of control become enormously big and give too dense a shade. Some planters cut the trees across and control them as low as 15 feet from the ground. Others prefer to cut them at 25′ to 30′ from the ground, keeping all the side branches cut off upto 15 feet. Albizzias, Acacias, and other trees are also planted for shade, but the Grevillea is mostly used.

(*To be continued*).

A Note on the Edible Fruits found wild in the Madras Presidency.

By K. CHERIAN JACOB, L. Ag., F. L. S.

Madras Agricultural Department.

Introduction. Fruits of several plants growing wild in the forests and waste places are either eaten when ripe or the unripe ones used in curries or pickles. Various kinds of wild fruits are collected from the forests and sold in the adjoining villages or towns. The edible portion in most cases is the pulp of the fruit. In rare instances the fleshy thalamus or the aril of the seed or the seed kernel is the edible part. These fruits are known under various local names in different parts of the Presidency. These names so far known are given alphabetically at the end of this note. The distribution of these fruit trees together with short descriptions and other particulars are given below:—

The Sweet Thorn Family.

1. *Flacourtia montana* Grah.

Kanarese: Hanusampage; Malayalam: Chalian Pazham.

It is a small tree found in the forests of the West Coast and the Western Ghats.

Fruits are edible and are available in the Palghat market.

The Mangosteen Family.

2. *Garcinia indica* Chois.

Kanarese: Murgina huli; Malayalam: Panampuli.

A slender tree with drooping branches found in the Western Ghats in South Kanara, Coorg and Wynaad.

The pulp of the seeds is edible.

3. *Garcinia Cambogia* Desr.

Tamil: Penampuli; Malayalam: Kodapuli.

It is a large tree with drooping branches found commonly in the Western Ghats from Coorg to Travancore.

The fruit is of the size of an orange with several deep vertical grooves. The pulp of the seeds is edible.

4. *Garcinia tinctoria* Dunn.

Tamil: Mukki; Telugu: Iwara mamidi; Kanarese: Deva garige; Malayalam: Anavaya.

It is an evergreen handsome tree found in the Northern Circars, the Western Ghats in Mysore, Coorg, Nilgiris and Travancore.

The fruit is of the size of an orange, smooth and bright yellow in colour. The pulp of the seeds is eaten.

The Olive Linden Family.

5. *Elaeocarpus serratus* L.

Tamil: Vlang karei; Verali palam; Kanarese: Bigada; Malayalam: Nalla kara.

It is a small tree found throughout the Western Ghats in the overgreen forests from South Kanara to Travancore.

The fleshy outer-portion of the fruits is eaten and is also made into pickles.

The Bastard Sandal Family.

6. *Erythroxylon monogynum* Roxb.

Tamil: Devadara, Chempulichi; Telugu: Adivi-gerenta; Kanarese: Devadaru.

It is a small tree found throughout the Presidency in dry forests.

The small red juicy fruits are eaten and are very refreshing.

The Wampee Tree Family.

7. *Clausena Willdenovii* W. & A.

Tamil: Kattukkariveppilai; Malāyalam: Kurakatu.

A small tree found in the Carnatic, Shevaroy Hills of Salem, Western Ghats from Mysore through Nilgiris to Travancore.

The fruit resembles currants and is very delicious.

The Citrus Family.

8. Feronia limonia (Linn.) Swingle (F. Elephantum Correa).

English: The Elephant Apple, The Wood Apple. Tamil: Vilangai, Vilam palam; Telugu: Velaga; Kanarese: Belathannu.

It is a large tree found in Northern Circars, Deccan and Carnatic in dry and open forests.

The fruit is of the size of a large orange. The pulp of the fruit is eaten. The fruit is sold in bazaars.

9. *Aegle Marmelos* Corr.

English: The Bael Tree; Tamil: Vilvam; Telugu: Maridu; Malyalam: Koovalam.

A small deciduous thorny tree found in Northern Circars, Deccan and Carnatic in dry forests; often cultivated in the West Coast.

Ripe fruits are sweet, nutritious and are sometimes eaten. Sherbet is also prepared of them.

10. *Garuga pinnata* Roxb.

Tamil: Kare vemba; Telugu: Garuga; Kanarese: Hala.

It is a large tree found in Northern Circars, Deccan from Hyderabad to Mysore, Western Ghats in South Kanara, Malabar and Coimbatore.

The fruit is of the size of gooseberry. It is eaten raw or pickled.

The Margosa Family.

11. *Azadirachta indica* A. Juss. (*Melia Azadirachta* Linn.)

English: The Neem or Margosa tree; Tamil: Veppam; Telugu: Veppa; Kanarese: Bevina-mara; Malayalam: Veppu.

It is a large tree found in the dry forests of Deccan and Carnatic.

The pulp of the fruit is eaten.

The Spindle Tree Family.

12. *Salacia reticulata* Wt.

Malayalam: Korandi pazharn.

It is a large climbing shrub found in the West Coast at Quilon, Kottayam and other places in Travancore. The pulp of the large tubercled fruit is edible.

The Jujube Family.

13. *Zizyphus Jujuba* Lam.

Tamil: Yellande, Ilantha; Telugu: Rengha; Kanarese: Yelchi; Malayalam: Cherumali.

A medium sized thorny tree found in all the dry districts of the presidency. The cultivated forms yield larger and better fruits. The fruits are sold in bazaars.

14. *Zizyphus Oenoplia Mill.*

Tamil: Kottei; Telugu: Paranu, Pariki; Malayalam: Mulli.

It is a thorny, straggling shrub found in all districts in dry forests. The small black fruits are pleasant to eat.

The Soapnut Family.

15. *Schleichera trijuga* Willd.

Tamil: Puvan; Telugu: Puska; Kanarese: Chakota; Malayalam: Puvam.

It is a large tree found in all forest districts. The aril of the seed is eaten.

16. *Nephelium Longana* Camb.

English: The Longan; Tamil: Puvatti, Katta puvan; Kanarese: Kanakindeli; Malayalam: Pasakotta.

It is a large evergreen tree found in the Western Ghats from South Kanara and Mysore to Tinnevelly. The aril of the seed is edible.

The Mango Family.

17. *Spondias mangifera* Willd.

English: The Indian Hog-plum; Tamil: Katmaa; Telugu: Adavi mamadi; Malayalam: Ambazham.

A fairly large tree found in deciduous forests in all districts up to about 2,000 feet. The fruits are eaten and are also pickled.

18. *Buchanania Lanzan* Spreng.

Tamil: Morala, Chara paruppu; Telugu: Morli, Sara; Kanarese: Nurkul; Malayalam: Munga pera.

It is a medium sized tree found in deciduous forests in all districts. The kernel of the seed is a common substitute for almonds and it is sold in bazaars.

19. *Buchanania lonceolata* Wt.

Tamil. Miricuda; Telugu. Pandijaruga; Malayalam, Mala maavu.

A medium sized tree found in the evergreen forests of Travancore.

The kernel of the seed is eaten.

20. *Buchanania ngustifolia* Roxb.

Tamil. Mudamah, Kolamavu ; Telugu. Morli sara, Pedda morali.

It is a medium sized tree found in Deccan and Carnatic in dry forests from Hyderabad to Travancore.

The kernel of the seed, the best of three species, is eaten.

21. *Semecarpus Anacardium* Linn. f.

Tamil. Shenkottei ; Telugu. Jiri ; Kanarese. Gheru ; Malayalam: Thenkotta.

A moderate sized tree found in all the deciduous forests of the Presidency.

The fleshy cup (hypocarp) on which the nut rests is edible.

The kernels of the nuts are also eaten.

The Leguminosae Family.

22. *Pithecolobium dulce* Benth.

English : Manilla tamarind ; Tamil : Korkapuli; Telugu : Simachinta; Kanarese : Sime hunase.

A moderate sized tree grown in all dry plains districts as a hedge plant.

The whitish pulp enveloping the seed is eaten. It is sold in bazaars.

The Rose Family.

23. *Rubus niveus* Thunb.

A straggling shrub found in all the mountainous tracts above 4000 feet.

The fruits are somewhat dry but are very palatable. Large quantities of them are sold in the bazaars of all hill stations.

24. *Rubus ellipticus* Sm.

A large straggling shrub found in the hills of Northern Circars and Deccan above 4,000 feet and of the Western Ghats usually above 6,000 feet.

The yellow fruits have the flavour of raspberry. It is either eaten raw or made into preserves. It is sold in bazaars in all hill stations. It is one of the best wild fruits of India.

25. *Rubus rugosus* Sm. var. *Thwaitesii* Focke.

A large scrambling shrub found in the Nilgiris and other hill stations above 5,000 feet.

The red fruits are edible and are also used in jam making.

The Strawberry Family.

26. *Fragaria milgherrensis* Schl.

A stout creeping wild strawberry found in the Western Ghats, Nilgiris; and Pulney Hills above 6,000 feet.

The fruits are pleasant to eat.

The Myrobalan Family.

27. *Terminalia Catappa* Linn.

English : The Indian Almond ; Tamil : Nat Badam ; Telugu : Bedam ; Malayalam : Adamaram.

A moderate sized deciduous and handsome tree grown in gardens and avenues.

The pulp of the fruit is eaten. The nut kernels with thin spirally folded cotyledons are eaten.

The Guava Family.

28. *Rhodomyrtus tomentosa* W.

English: Hill Gooseberry; Tamil: Kattu Koyya; Kanarese: Tavuti; Malayalam: Koratta.

A thickly tomentose shrub found in the Nilgiri and Pulney Hills above 5,000 feet.

The fruits are pleasant to eat. They are sold in bazaars in the hill stations.

The Rose Apple Family.

29. *Syzygium zeylanicum* DC.

Tamil: Marungi; Kanarese: Kunnerale; Malayalam: Pula.

A small handsome tree found in the Western Ghats from South Kanara to Travancore.

The white fruits are edible.

30. *Syzygium Jambolanum* DC.

English: Black Plum; Tamil: Naval; Telugu: Neredu; Kanarese: Nerale; Malayalam: Naga.

A large evergreen tree found in all forest districts of the Presidency.

The purple fruits are eaten and are sold in bazaars. This fruit is not to be eaten extensively as it is apt to bring on fever.

The Bilberry Family.

31. *Memecylon edule* Roxb.

English: The Iron Wood tree; Tamil: Kaya; Telugu: Alli; Kanarese: Alamaru; Malayalam: Kalayam.

A large shrub found in the hilly tracts of Northern Circars, North Arcot, Cuddapah and other places.

The small black purple fruits are eaten.

The Oenothera Family.

32. *Trapa bispinosa* Roxb.

English: The Water-chestnut, the Singhara Nut; Tamil: Singhara.

A floating plant found in wells, tanks and pools in many places of the Presidency.

The kernel of the fruit is eaten either raw or cooked.

The Gourd Family.

33. *Coccinia indica* W. & A. (*Cephalandra indica* Naud.)

Tamil: Kovai; Telugu: Kaidonda.

A pretty climber found in most plains districts of the Presidency on hedges and bushes.

Both ripe and unripe fruits are eaten raw or cooked.

34. *Momordica dioica* Roxb.

Tamil: Palupaghel Telugu: Potukandulu; Kanarese: Gid hagalu.

A perennial tuberous-rooted climber found in the plains districts of the Carnatic and West Coast up to 4,000 feet.

The tender fruits are made into curries and eaten.

35. . *Momordica tuberosa* Cogn.

A trailing plant with tuberous rootstock found in Deccan and Carnatic, in Mysore, Bellary, Anantapur and down to Tinnevelly on black cotton soils.

The dark green and ribbed fruits are edible.

The Cactus Family.

36. *Opuntia Dillenii* Haw.

English: The Prickly Pear; Tamil: Seppathi kalli Telugu: Nagadali; Kanarese: Cappatigalli; Malayalam: Nagamullu.

A ramous spiny bush indigenous to Tropical America but naturalized in all the southern districts of the Presidency.

The red fruits are eaten by poor people.

The Heath Family.

Gaultheria fragrantissima Wall.

English: The Indian Winter Green.

A large shrub found in the Western Ghats, Nilgiris, Pulneys and hills of Travancore above 6,000 feet.

The fruits are edible.

The Sapodilla Family.

38. *Sideroxylon tomentosum* Roxb.

Tamil: Palai; Kanarese: Hudugolla. A thorny tree found in Northern Circars, hills of South Kanara to Coimbatore in dry forests. The fruits are used in curries and are also pickled.

39. *Bassia latifolia* Roxb.

English: The Mahua tree; Tamil: Iluppai; Telugu: Ippa: Kanarese: Ippi.

A large deciduous tree found in Northern Circars, Deccan, in the Nallamalai hills and south to North Arcot, Salem and Coimbatore.

The fruits and the succulent flowers (corollas) are eaten raw or cooked.

The Ebony Family.

40. *Diospyros Melanoxylon* Roxb.

English: Coromandel Ebony; Tamil: Tumbi; Telugu: Tumi, Tumki; Kanarese: Balai.

It is a moderate sized deciduous tree found in Northern Circars, Deccan and Carnatic.

The fruits are eaten.

41. *Diospyros tomentosa* Roxb.

Tamil : Tumbi ; Telugu : Chitta tumiki ; Kanarese : Kaulay.

A large tree found in Northern Circars down to the Godaveri in deciduous forests.

The fruit is edible.

The Mustard Free Family.

42. *Azima tetracantha* Lam.

Tamil : Chengam chedi ; Telugu : Thella-upi ; Kanarese : Bilivuppi ; Malayalam : Sankunkuppi.

It is a straggling thorny shrub found in the Circars, Deccan and Carnatic.

The white berries are eaten.

The Bengal Current Family.

43. *Carissa spinarum* Linn.

Tamil : Chiru Kila ; Telugu : Wakoilu.

A thorny shrub with zig-zag branches found in Northern Circars and Carnatic down to Travancore in dry scrub forests.

The small dark-purple fruits are eaten and are sometimes sold in bazaars.

44. *Carissa Carandas* Linn.

Tamil : Kalaka ; Telugu : Kalivi ; Kanarese : Karekai.

A large thorny shrub found in Northern Circars, Deccan and Carnatic in dry forests ; often cultivated.

The purple fruits are eaten and the green ones are made into pickles.

45. *Carissa paucinervia* A. DC.

Malayalam : Kari-mulli.

A diffuse spiny shrub found in Deccan, hills of Mysore, Salem and Coimbatore ; Western Ghats, Nilgiri hills, etc. Dark purple fruits are eaten.

The Poison Nut Family.

46. *Strychnos potatorum* Linn. f.

English : The Clearing Nut ; Tamil : Tetthan Kottai ; Telugu : Chilla ; Kanarese : Chilu.

A medium sized tree found in Northern Circars, Deccan and Carnatic to Travancore, in deciduous forests.

The black pulp of the fruit is eaten. Young fruits are made into preserve.

The Sebesten Family.

47. *Cordia obliqua* Willd.

Tamil : Vidi, Shiru Naruvilli ; Telugu : Iriki, Nakkeri ; Kanarese : Challe ; Malayalam : Virusham.

A moderate sized deciduous tree found in all forest districts.

The mucilaginous ripe fruits are eaten.

48. *Cordia Wallichii* G. Don.

Same local names as for No. 47.

A moderate sized tree found in Deccan and Western Ghats in deciduous forests.

The mucilaginous ripe fruits are eaten.

The Night shade Family.

49. *Solanum nigrum* Linn.

English: Garden night-shade; Tamil: Mana-thakkali; Telugu: Kamanchi chettu, Kanchi chettu; Malayalam: Mulaku-thakkali.

An erect annual herb found in all districts.

The sun dried unripe berries are eaten as curries and are considered very cooling.

50. *Solanum pubescens* Willd.

Tamil: Sundakkai; Telugu: Kasivuste; Kanarese: Sonde; Malayalam: Cheria Chunda, Chundanga.

A large shrub found in Deccan and Carnatic to the east slopes of the Western Ghats in open scrub forests.

The sundried unripe fruits are eaten as curries.

51. *Solanum indicum* Linn.

English: Indian night-shade; Tamil: Siru Sundai; Telugu: Thella Molakai; Malayalam. Puththeri Chunda.

A branched prickly undershrub found in all districts in the plains and lower hills.

The fruits are used as vegetable.

The Oleaster Family.

52. *Elaeagnus conferta* Roxb.

Tamil: Kolungai; Kanarese: Hittele, Hulige; Malayalam: Kayalam-puvalli.

A large often thorny straggling shrub found in Northern Circars, West Coast and Western Ghats at low levels.

The red fruits are edible and are sold in bazaars.

53. *Elaeagnus Kologa* Schlecht.

Local names are same as for No. 52. A large sometimes thorny climbing shrub found in the margins of shola forests in Western Ghats Nilgiris and Pulneys. The orange red fruits are edible and are sold in bazaars in the hill stations.

The Gooseberry Family.

54. *Emblica officinalis* Gaertn. (*Phyllanthus emblica* Linn).

English: The Emblic Myrobalan; Tamil: Nelli; Telugu: Usiriki; Kanarese: Nelli; Malayalam: Nelli.

A moderate sized deciduous tree found in Northern Circars, Deccan and Carnatic and also in Western Ghats. The unripe fruits are used for pickles and are sold in bazaars.

55. *Emblica Fischeri* Gamble.

Local names, distribution, etc., same as for No. 54. The unripe fruits are used for pickles.

The Kokra Laurel Family.

56. *Aporosa Lindleyana* Baill.

Tamil : Vittil ; Kanarese : Sulla, Sali : Malayalam : Vetti.

A medium sized evergreen tree found in the Western Ghats from South Kanara and Mysore to Anamalais and Travancore in evergreen forests. The ripe fruits are edible.

The Chinese Laurel Family.

57. *Antidesma Menasu* Miq.

Tamil: Nirilai; Telugu: Nakkagadamu; Malayalam: Putharaval.

A small tree found in the Western Ghats, hills of North Coimbatore, Shevaroy Hills of Salem, etc., in evergreen forests.

The small red fruits are edible.

88. *Antidesma diandrum* Roth.

Tamil: Acarippuli; Telugu: Pellagumudu; Kanarese: Sannaguige.

A small deciduous tree found in Northern Circars, Deccan and Carnatic and at low levels to Travancore.

The purplish-red small fruits are edible.

59. *Antidesma Ghaesembilla* Gaertn.

Telugu; Polari, Pulsur; Kanarese: Pulimpurase; Malayalam: Ceriyannatim.

A small deciduous tree found in Northern Circars, Deccan and Carnatic at low elevations.

The red purple fruits are edible.

The Spurge Family.

60. *Baccaurea courtallensis* M. Arg.

Tamil : Puvai ; Kanarese : Kolikuki ; Malayalam : Mutta Thuri.

An evergreen tree found in the Western Ghats from South Kanara to Travancore. The crimson fruits about 1″ in diameter are edible.

61. *Aleurites moluccana* Willd.

English : The Candle Nut ; Tamil : Nattu-akrottu-kottai ; Telugu : Nattu-akrottu-vittu ; Kanarese : Natakrodu ; Malayalam : Akrottu.

A hand-some tree found in the Western Ghats in the Wynaad. The kernels are edible and taste like walnut.

The Big Family.

62. *Ficus glomerata* Roxb.

Tamil : Telugu : Kanarese and Malayalam : Atti.

A large deciduous tree found in all districts in evergreen forests. The ripe fruits are edible.

The Jak Family.

63. *Artocarpus hirsuta* Lam.

Tamil : Ayani Pila ; Kanarese : Halasu ; Malayalam : Anhili Pilavu, A very large evergreen tree found in evergreen forests of the West Coast, Coorg, Mysore, Wynaad and Anamalais to Travancore. The fruit resembles a miniature jak fruit and the fleshy perianth is eaten and is very delicious.

64. *Artocarpus Lakoocha* Roxb.

Tamil : Colaippakku ; Telugu : Nakkarenu ; Kanarese : Lakuca ; Malayalam : Lakucam.

A large deciduous tree found in the hill forests of Coorg, Mysore, West Coast, Ganjam, Vizagapatam, etc.

The fruits are edible.

The Date Palm Family.

65 *Phoenix sylvestris* Roxb.

English : The Wild Date Palm ; Tamil : Icham ; Telugu : Pedda-ita ; Kanarese : Ichal.

A large palm attaining a height of 30 to 40 feet found in all dry districts of the Presidency.

The ripe fruits are edible.

66. *Phoenix farinifera* Roxb.

Tamil : Ithi ; Telugu : Chitti-sita, Chiruta-ita ; Kanarese : Ichal.

A small tree growing to about 2' in height found especially in coastal regions of the Presidency.

The ripe fruits are sweet and are eaten.

67. *Phoenix humilis* Royle., var. *pedunculata* Becc.

Tamil : Malai Icham ; Telugu : Konda-ita ;

Stems 1 to 2 feet in height. Found in all the hilly districts.

The ripe fruits are sweet and are edible.

The Palmyra Family.

68. *Borassus flabellifer* Linn.

English : The Palmyra Palm ; Tamil : Panei ; Telugu : Tatti ; Kanarese : Tali ; Malayalam : Karum-pana.

A tall palm attaining a height of 50 to 60 feet found in most districts.

The ripe fruits are eaten by poor. The kernel of the young nut is much relished and is sold in bazaars.

The alphabetical list of common and local names of the edible fruits found wild in this Presidency.

ABSTRACTS

The Genetics and Chemistry of Flower Colour Variation. W. J. C. Lawrence and J. R. Price. (Biological Reviews) Vol. 15 (1940) No 1.

Colour is one of the characters of plants and animals most frequently used in genetical investigations. Separation of colour types by visual comparisons alone is inadequate and sometimes misleading as they represent only a first analysis. For a further understanding of the developmental processes involved a knowledge of the chemical structure and properties of the pigments responsible is needed. It is in the flower pigments that gene action can also be examined in its fundamental sense, namely as governing simple chemical changes: oxidation, reduction, methylation and glycoside formation.

The great majority of flower pigments belong to three main classes, the anthocyanins and the anthoxanthins, both of which are sap-soluble, and the carotinoids, which are generally found in the plastids and are not sap soluble. Most of the anthocyanins are derived from three hydroxy-flavylium salts viz., pelargonidin, cyanidin and delphinidin These substances are the colour producing part of the anthocyanin molecule. They occur in combination with one or two molecules of a sugar, this compound being an anthocyanin. In themselves they differ only in the number of hydroxyl groups in the 2 phenyl nucleus cyanidin for example has one more hydroxyl group in the molecule than pelargonidin and delphinidin two more This is one of the principal factors upon which variation in flower colour depends, as an increase in the number of oxygen atoms causes a marked increase in blueness of tone. The scarlet pelargonium, deep red rose and purple delphinium are good examples of colours due to pelargoridin, cyanidin and delphinidin derivatives respectively. There are two other factors viz. methylation of hydroxyl groups and the position of attachment of sugar molecules which influence the colour of anthocyanins and the combinations of the three factors give rise to 12 anthocyanins each slightly different in colour, but together covering a wide range from scarlet to purple. These variations are due to differences which are internal. Conditions external to the molecule may also affect the colour of anthocyanins such as copigmentation or the pH of the cell sap. The anthoxanthins are glucosides which range in colour from ivory to yellow. There are four ways in which they may be concerned in flower colour: (a) in flowers which have no anthocyanin they may be directly responsible for some or all of the colour (b) when a yellow anthoxanthin occurs together with an anthocyanin, the resultant colour is a blend of the two (c) in the presence of anthocyanins, ivory anthoxanthins do not contribute independently to the colour, but they may do so indirectly by their "copigmenting" action. Copigments are substances which when present in the same solution as an anthocyanin form weak additive complexes that are much bluer than the anthocyanin alone (d) the presence of much anthoxanthin may lead to almost complete suppression of anthocyanin (these two classes of substances are formed from the same starting materials limited in quantity). The carotinoids comprise a number of yellow or orange substances, xanthophylls and carotins. In the absence of anthocyanins they are either solely responsible for flower colour, or are supplemented by yellow anthoxanthins. In the presence of anthocyanins the colour is a blend of the two.

Pigment production is genetically controlled and in a number of cases complementary genes are involved. Variation in the amount of any pigment is also gene controlled. Modifications of the chemical structure of anthocyanins, including the state of oxidation, glycosidal type and probably the degree of methylation are each determined by simple gene relationships. Heritable chemical differences result in the first place from gene action. They may be accentuated or minimised by gene interaction, which can modify dominance

relationships and is sometimes the cause of epistasy. Extensive literature has been cited on the subject. U. N. R.

Growth of lemon fruits in relation to moisture content of soil— Furr, J. R., and Taylor, C. A.—Tech. Bull. U. S. Dep. Agric. 640, 1938, pp. 71. bibl. 19; 15 cents;—

The investigations recorded were undertaken in California to determine the response of lemon trees to variations in soil moisture conditions within the root zone, in the proportion of soil wetted and in the length of time between irrigations. Changes in apparent growth rate of lemon fruits were found to serve as an excellent index of the relative water deficit of the tree, turgor deficit arising before the first visible sign of leaf wilting or any decrease in the transpiration rate occur. Root concentration and soil moisture extraction varied greatly in all orchards examined. The moisture content of regions of highest root concentration was reduced to wilting range (i. e. the period between the permanent wilt of basal leavas on well established sunflower plants to the complete wilt of all leaves) before a water deficit was evident from fruit measurements. Before the moisture content of all the soil of any easily delineated zone, such as the top foot, had reached wilting range, appreciable parts of the soil had remained in wilting range for long periods and high water deficits had developed in the trees. It was possible when first water deficit developed in the fruit to find soil moisture contents varying from within wilting range to near field capacity. These variations in the most uniform orchards were great enough to render averages of soil moisture percentages unreliable as a measure of the water supply of the trees. In field experiments, if only one half the surface area was maintained with soil moisture above the wilting range, the trees received an ample water supply. Variability in root concentration prevented the determination by ordinary methods of soil sampling of the actual proportion of soil in the root zone that was reduced into the wilting range without causing severe water deficit or reduction in the final size of the fruit. The rate of extraction of water from one part of the soil in the root zone was influenced by the moisture content of the soil in other parts of the root zone. If water was applied only when apparent growth of fruit was unaffected on heavy and medium soils but reduced on light soils. On plots of all three soil types water withheld until apparent growth of fruit ceased or leaves began to roll resulted in pronounced reduction of final fruit size, some loss of leaves and, on the light soil, in injury to small twigs. Fruit measurements should be used not to predict when water should be applied, but to determine whether established practices are producing desired results. If fruit growth decreases materially before irrigation and increases sharply after irrigation, it is evident that there was an appreciable water deficit prior to irrigation and the measure of this deficit may be gauged from the magnitude in the difference in growth rate just before and just after irrigation. (*Horticultural Abstracts* 9 (1939) : 259)

Unique method of drainage devised by San Fernando grower, Anon. Calif. Citrogr., 1939, 24 : 120.

In an orchard in California which it was impossible to drain in the ordinary way without running the water on to an orchard on a lower level, a new method was devised. At the 5 lowest points pits 2 feet in diameter were drilled to sand 35 feet below. The holes so made were filled with cement pipes in 3 ft. lengths standing one on top of the other but not cemented together. To these holes the drains were led. Instead of using the customary perforated tile pipes, trenches 4 feet deep with a 3% fall were dug. In the bottom of each trench a small trench, in depth the width of a shovel or 8 inches square was made. The small trench was filled with stones up to 2 inches and were then filled in with soil. The trenches are connected with the drainage pits by 7 joints. The results are said to have restored the failing orchard to health.

(*Horticultural Abstracts* 9 (1939) : 260).

EXTRACTS

Note on a Method of Raising Seedlings for Arid Districts.

Trouble is often experienced in establishing seedling trees and shrubs in arid districts, owing to the low moisture content of the surface soil. In drought years the same difficulty is encountered in districts that normally have a good rainfall.

The method described aims at producing seedlings with longer root systems than are obtained with ordinary nursery practice. A long root system enables the seedling plant to be independent of moisture in the top six inches of soil, to draw on sub-soil moisture as soon as it is planted out. The procedure is as follows:— Bamboos with an internal diameter of not less than 2 in. are cut into sections 20 in. long one end being cut just below a node, which forms the bottom of th receptacle. A hole about $\frac{3}{8}$ in. diameter is made in the bottom of each section. The bamboos are then split in half longitudinally, and one half of each section is soaked in a $1\frac{1}{2}$ per cent solution of sulphate of ammonia for several hours.

After soaking the halves are fitted together again and secured with wire of suitable gauge, at top and bottom.

Thus one half of each 'pot' has been treated with sulphate of ammonia, and the other half remains untreated.

Seed should be sown in boxes or nursery beds. When the seedlings are large enough to handle they are transplanted to the pots which have been filled previously with a good potting mixture.

The land where planting is to be done is prepared by digging a large hole for each tree, manuring and filling in the holes again.

Planting is carried out as follows:— A hole the length of the bamboo pot is made with a crowbar, the wires which hold the pot together are removed, and the halves of the pot are separated. The roots of the plant will be clinging to the half of the pot that has been treated with sulphate of ammonia; this is inserted in the hole with the plant, thus preventing any buckling of the roots, soil is then filled in and firmed down in the ordinary way.

(*The East African Agricultural Journal* Vol. 5. No. 5. p. 363).

Progress of the Agricultural Adjustment Act Programme in the U. S. A.

Six years have now passed since the Government began to balance supply with demand to raise prices of agricultural crops, to improve soil and to promote a sounder farm programme in the South. Before 1933 the farmers bought in a protected market and sold in an open market with no offsets. The A. A. A. began to offset this inequality in agriculture by the adoption of several methods. The results may be summarised as follows.

The average area under cotton during the four years prior to 1932—33 was 41·5 million acres. This has been cut by an average of 16·5 million acres a year in the past six years. The total cash income to the cotton growers from cotton, lint, seed and government payments in the three years before the A. A. A. and in the six years after the A. A. A. is given in the table.

Year.	Total value of lint and seed in million dollars.	Payment by Govt. in million dollars.	Grand total in million dollars.
1930—31	752		752
1931—32	526		526
1932—33	464		464
1933—34	678	180	858
1934—35	735	115	850
1935—36	695	160	855
1936—37	906	82	988
1937—38	913	65	978
1938—39	598	266	860

It will be plain that despite the smaller area, the total income was more. Besides, the acre yields in cotton have increased. From 1923—1932 the average cotton yield per acre was 169·9 lb. of lint, from 1928—1932 the yield was 173·9 lbs. The average for the last seven years 1933—1939 was 217 lb. During the same period the decrease in the cotton area was 38·7% but the cut in cotton lint production was only 11% due to the higher yield per unit area.

The extra land released from cotton was used for the production of food and feed. The area under cotton has gone up by a million acres, oats by three hundred and thirty seven thousand acres, wheat by two and three quarters of a million acres, all hay two and a quarter million acres, sweet sorghum by more than a million acres, sorghum by half a million, cowpeas by nearly a million, peanuts by three hundred thousand acres, truck crops by two hundred thousand acres, interplanted legumes nine million acres, and legume crops for soil improvement in million acres.

Something over 325 million feet of terraces have been built on eroded farms and thousands of acres of forest land have been replanted by farmers.

In other words the farmers are building up some assets that may be cashed in later on in the shape of better farms with better yields on account of their following the programme set out by the government during the last six years.

[Abstracted from the article "Farmers to ballot on quotas" by Stanley Andrews, *American Cotton Grower*, December 1939.]

Gleanings.

Cockroaches and their control: These household pests are nocturnal in habit, hiding in any dark crevices, corners or cupboards during the day, and coming out to feed at night. Kitchens are particularly favoured by the attention of these obnoxious insects, but by carefully locating any sheltering sites they are fairly easily treated.

The most satisfactory chemical for killing these insects is sodium fluoride, a white powder. Although poisonous to humans, if taken internally in sufficient quantity, provided reasonable care is taken in its use, the risk of contamination of foods is negligible.

The best method of reaching the cockroaches is to dust this powder into crevices by means of a small blow-gun or bellows, or scatter it on the floor and shelves of cupboards. The insects pick up the powder on the legs and antennae (feelers) and, in order to clean off the powder, drain these members between the mouth parts; by this means the poison passes to the stomach and kills the insects.

In dry situations, the powder remains more or less indefinitely, but where subject to moisture, it is liable to cake and become useless. In such cases, it may be advisable to blow the dust into the hiding places once a week at least,

Another matter that should receive careful attention is the masses of eggs. These are enclosed in a brown capsule, about half an inch long and rounded on the ends; the outer side is often covered with a white mealy-like powder. These are placed in cracks along wainscotting, crevices, behind doors etc. Wherever found, they should be destroyed, as each capsule contains a number of eggs.

As cockroaches breed in heaps of decaying leaves etc., care should be taken to turn over periodically any heaps of garden rubbish etc., in the vicinity of dwellings. (*The New Guinea Agricultural Gazette*, Vol. 5, No 3, p. 4).

Britain, the World's Pedigree Stock Farm. Being interested in the agricultural and stock position in war-time Britain and watching the trend of events on "the other side" one comes across some very interesting and unusual facts at times. Going through the list of different breeds of live-stock, one is amazed at the number—some of which we in Queensland rarely hear about. The British Isles have been termed the pedigree stock farm of the world; and rightly so, when one realises that it is the home of ninety-five distinct breeds of stock—to say nothing of the various crosses of these breeds.

The figures are :—Four distinct breeds of heavy draught horses; sixteen light horse breeds, fifteen beef and dual purpose cattle breeds, nine dairy cattle breeds, nine long-wooled sheep breeds, eleven downs and other sheep breeds; thirteen mountain sheep breeds, twelve breeds of pig; and six breeds of goats.

The remarkable thing is that each breed is flourishing and has a large following of "fanciers". (*Queensland Agricultural Journal*, Vol. LIII (1940) ; 422).

Cows with Head and Tail lights for War-time "Black-outs". The nightly 'black-out' in the Old Country is causing considerable anxiety to many stock-owners. This is how one English farmer solved his difficulty :

After several of his cows had wandered on to dark country roads at night and been killed by passing motor cars and trucks he thought out a plan for placing head and tail lights on his cattle. Tiny lamps powered by small dry cells were fixed to the horn and tails of the animals, making them visible to motorists coming from either direction along the roads bordering his farm.

(*Queensland Agricultural Journal*, Vol. LII, (1940) : 422).

Crop and Trade Reports.

Cotton—1939-40—Fifth or final report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 9·9 per cent of the total area under cotton in India.

2. The area under cotton in the Madras Province in 1939-40 is estimated at 2,206,200 acres as against 1,957,600 acres for the corresponding period of last year and 2,102,900 acres according to the forecast report issued in February. The present estimate for the Province represents an increase of 13·1 per cent as compared with the finally recorded area of 1,970,224 acres in 1938—39. The final estimate of last year exceeded the actuals by 0·4 per cent.

3. The increase in area in the current year as compared with the area in 1938—39 occurs in all the important cotton growing districts of the Province outside East Godavari and Nellore and is attributed to favourable rains and good prices during the sowing season. The variations are marked in Coimbatore (plus 107,500 acres), Ramnad (plus 39,600 acres) and Madura (plus 27,500 acres). The area estimated in respect of the Nellore district is the lowest reported in recent years.

Picking of cotton is in progress and may be finished in about a month.

4. Normal yield is expected in the Circars (Guntur excepted), Bellary, Cuddapah, Chittoor, Salem, Tinnevelly (Tinnevellies cotton) and South Kanara. A yield below normal is expected in the other districts of the Province due mainly to drought. The estimated yield is very low in Coimbatore (32 per cent for Uppam cotton, 44 per cent for irrigated Karuganni and 47 per cent for Nadam cotton and 74 per cent for rainfed Cambodia) and Tinnevelly (51 per cent for irrigated Cambodia and 61 per cent for rainfed Cambodia),

The seasonal factor for the Province as a whole works out to 77 per cent of the average for irrigated cotton and 92 per cent for unirrigated cotton, the corresponding figures according to the Season and Crop Report of last year being 85 per cent and 92 per cent respectively. On this basis, the yield works out to 420,900 bales of 400 lb. lint as against 372,010 bales of last year which represents an increase of 13·1 per cent. The yield in an average year is estimated at 506,570 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

5. The estimated area and yield under the several varieties are given below:

(Area in hundreds of acres i. e., 00 being omitted; Yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted).

Variety.	Area 1939—40 Acs.	Area 1938—39 Acs.	Corresponding yield. 1939—40 Bales.	Corresponding yield. 1938—39 Bales.
Irrigated Cambodia	178,5	152,0	88,3	82,0
Dry Cambodia	191,3	187,9	33,8	35,6
Total, Cambodia.	369,8	339,9	122,1	117,6
Uppam in the Central Districts	25,8	20,1	2,8	2,8
Nadam and Bourbon	25,1	3,3	6	2
Total, Salem.	50,9	23,4	3,4	3,0
Tinnevellies *	709,3	575,2	157,5	139,9
White and red Northerns	195,0	175,0	23,2	22,2
Westerns	766,0	715,0	94,8	85,6
Warrangal and Cocanadas	107,2	123,3	18,9	19,9
Chinnapatti (Short staple)	8,0	5,8	1,0	7
Province.	2,206,2	1,957,6	420,9	388,9

* Includes Karunganni cotton grown in the Coimbatore district and Uppam, Karunganni and mixed country cotton grown in the South.

6. The table below gives final information so far as it is available on the crop of 1937-38:—

(Figures in hundreds of bales of 300 lb. lint, i e. 400 being omitted).

Item.	Particulars.	South. Tinnevellies and	South. Cambodia.	Deccan, Northerns & Westerns.	Rest of the Province, Cocanadas & others.	Total.
	1.	2.	3.	4.	5.	6
1.	Pressed at presses and loose cotton received at mills in 1939—40	1,274	1,460	1,846	383	4,963

2. Subtract crop of 1937—38 pressed at presses and loose cotton received at mills in 1939—40 i. e., stocks of loose cotton held by the trade, ginneries, presses and mills on 31st January 1939.	287	399	154	65	905
3. Add loose cotton of the crop of 1938—39 held by the trade, ginneries presses and mills on 31st January 1940.	118	137	22	40	317
4. Add estimate of extra factory consumption.	37	Nil	38	25	100
5. Total crop of 1938—39.	1,142	1,198	1,752	383	4,475
6. Yield as estimated in April 1939.	1,429	1,176	1,078	206	3,889
7. Yield as estimated in the Season and Crop Report of 1938—39.	1,257	993	1,287	183	3,720

Note:— (1) The year 1939-40 relates to the period February 1939 to January 1940, whon the crop of 1939-40 generally comes to the market. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) Items 2, 3 and 4. The figures are approximate.

7. The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lbs. equivalent to 3,200 tolas as reported from important markets on 9th April 1940 was about Rs. 21—6—0 for Cocanadas, Rs. 19-12-0 for white Northerns, Rs. 21-6-0 for red Northerns, Rs. 22—12—0 for Westerns (Jowari crop), Rs. 18—13—0 for Westerns (Mungari crop), Rs. 32—6—6 for Coimbatore Cambodia, Rs. 27—11—0 for Southern Cambodia. Rs. 29—14—0 for Coimbatore Karunganni, Rs. 27—8—0 for Tinnevelly Karunganni, Rs. 26—3—0 for Tinnevellies and Rs. 25—3—0 for Nadam cotton. When compared with the prices published in the last report, i.e., those which prevailed on 5th February 1940, these prices reveal a fall of about 18 per cent in the case of Westerns (Mungari), 17 per cent in the case of white Northerns, 16 per cent in the case of red Northerns, 15 per cent in the case of Tinnevellies, 11 per cent in the case of Westerns (Jowari) and Southern Cambodia. 10 per cent in the case of Tinnevelly Karunganni and 6 % in the case of Coimbatore Karunganni. 5 per cent in the case of Coimbatore Cambodia and 3 per cent in the case of Cocanadas cotton and a rise of about two per cent in the case of Nadam cotton.

Crop—Groundnut—1940—First report. The area sown with summer or irrigated crop of groundnut during the three months January to March 1940, is estimated at 42,800 acres. When compared with the estimated area of 46,400 acres for the corresponding period of last year, there is a decrease of 7·8 per cent.

2. Figures by districts are given below:—

District.	Estimate of area sown with irrigated groundnut from January to March. 1940	1939	Increase (+) or decrease (−) of the area in column (2) as compared with the area in column (3).
(1)	(2)	(3)	(4)
	Acres	Acres	Acres
Anantapur	200	300	− 100
Cuddapah	2,000	2,000	Nil.
Nellore	100	100	Nil.
Chingleput	6,000	6,000	Nil.
South Arcot	20,000	20,000	Nil.
Chittoor	5,000	5,000	Nil.
North Arcot	1,500	2,000	− 500
Trichinopoly	1,000	2,000	− 1,000
Tanjore	3,000	3,000	Nil.
Madura	3,000	5,000	− 2,000
Ramnad	1,000	1,000	Nil.
Total.	42,800	46,400	− 3,600

3. The wholesale price of groundnut (shelled) per Imperial maund of 82⅔ lb (equivalent to 3,200 tolas) as reported from important market centres on 9th April 1940 was Rs. 5—8—0 in Cuddalore, Rs. 5—2—0 in Guntur, Rs. 5—1—0 in Vizagapatam, Rs. 4—12—0 in Vizianagaram, Rs. 4—11—0 in Vellore, Rs. 4—10—0 in Tadpatri, Rs. 4—9—0 in Anantapur, Rs. 4—8—0 in Cuddapah, Rs. 4—7—0 in Nandyal, Rs. 4—5—0 in Adoni and Hindupur and Rs. 4—4—0 in Bellary. When compared with the prices on or about the same date last year, these prices reveal a rise of approximately 42 per cent in Tadpatri, 38 per cent in Adoni and Hindupur, 37 per cent in Nandyal, 34 per cent in Vellore, 33 per cent in Bellary and Cuddapah, 32 per cent in Guntur, 31 per cent in Cuddalore, 29 per cent in Vizagapatam, 23 per cent in Vizianagaram and 16 per cent in Anantapur.

Gingelly—1939-1940—Fourth or final report. The average of the areas under gingelly in the Madras Province during the five years ending 1937—1938 has represented 15·6 per cent of the total area under gingelly in India.

2. The area sown with gingelly in 1939-1940 is estimated at 803,900 acres. When compared with the area of 821,000 acres estimated for the corresponding period of last year, it reveals a decrease of about 2·1 per cent. The present estimate also reveals a decrease of about 8·3 per cent as compared with the finally recorded area of 876,397 acres last year. The area in an average year is estimated at 764,060 acres.

3. 202,000 acres have been reported as sown since the previous forecast report was issued in January as against 245,700 acres during the same period last year. These late sowings were mainly on wet lands in Vizagapatam, East Godavari, West Godavari, Cuddapah, Nellore, South Arcot, Trichinopoly and the south where gingelly was raised as a second crop after paddy.

4. As compared with the actual area sown last year, there has been a decrease in area in the Circars, the Deccan (Anantapur excepted), Nellore, South Arcot, Chittoor, Trichinopoly, the South and Malabar partly counterbalanced by an increase in area in the other districts of the Province. The variations are marked in North Arcot (+25,100 acres,) Salem, (+49,100 acres) and

Tinnevelly (−71,700 acres.) The areas reported for Anantapur, North Arcot, Salem and Coimbatore are the highest on record while the areas reported for Tanjore and Tinnevelly are the lowest on record.

5. The yield is estimated to be normal in Cuddapah, Salem and South Kanara and below normal in the other districts due mainly to drought, especially in South Arcot (60 per cent) and North Arcot (71 per cent). The condition of the late sown crop is not satisfactory except in the Circars and Cuddapah.

The seasonal factor for the Province as a whole works out to 84 per cent of the average as against 79 per cent according to the Season and Crop Report of last year. On this basis the total yield works out to 90,100 tons. This represents a decrease of 3·9 per cent when compared with the estimate of 93,760 tons in the Season and Crop Report of last year. The yield in an average year is estimated at 104,020 tons.

6. The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th April 1940 was Rs. 8 in Cocanada, Rs. 7—14—0 in Trichinopoly, Rs. 7—12—0 in Tinnevelly, Rs. 7-7-0 in Tuticorin Rs. 7—1—0 in Salem, Rs, 6—11—0 in Ellore and Cuddalore, Rs. 6—8—0 in Vizagapatam and Vizianagaram and Rs. 6—5—0 in Rajahmundry. When compared with the prices published in the last report, i. e., those which prevailed on 5th February 1940, these prices reveal a rise of approximately 20 per cent in Trichinopoly and Tuticorin, 13 per cent in Cuddalore and Tinnevelly, 11 per cent in Salem, 10 per cent in Ellore, 7 per cent in Cocanada and 6 per cent in Rajahmundry and a fall of approximately 7 per cent in Vizagapatam, the price remaining stationary in Vizianagaram. *(From Director of Industries, Madras.)*

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 3rd May 1940 amounted to 165,103 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939—40. The receipts in the corresponding period of the previous year were 157,627 bales. 162,308 bales mainly of pressed cotton were received at spinning mills and 8,483 bales were exported by sea while 49,259 bales were imported by sea mainly from Karachi.

(From Director of Agriculture, Madras),

Mofussil News and Notes.

Besthvaripet, Cambum Taluk (Cuddalore) Exhibition. An Agricultural exhibition was held on 29th and 30th April at Dasthavaripet during the refresher course of Elementary School teachers. The working of bund-former, H. H. Guntaka, buckscraper and mouldboard ploughs was demonstrated. The local demonstrator exhorted the teachers to play their part in improvement of agriculture, and the ryots of the locality to rationalise agriculture. N. A.

Kollegal-Cattle fair at Madeswaran hills. The annual cattle fair at Madeswaran hills was held during Mahasivaratri festival from 9th to 11 March. The animals gathered this year were slightly below the usual standard exhibited in this breeding tract. One notable feature was a fairly large sale of drycows for agricultural work. These cost Rs. 40 to Rs. 50 per pair, while good working bullocks cost from Rs. 80 to Rs. 100 per pair.

An agricultural exhibition was held which attracted from four to five thousand visitors from the rural areas. They were all impressed by the exhibits which included improved implements, improved strains of sugarcane (Co. 417 and 419) and cereals, and improved models of cattle sheds. A similar exhibition held at Budivalu village from 23rd to 25th March was also a success. A special feature in this village was the fitting up of Kirloskar handpump for a well dug

with the aid of the Rural Development fund which has proved a blessing to the village. U. L. S.

Pattukotai-Exhibition. An enhibition of livestock was conducted on 7—4—40 during the S. P. C. A. annual show when large number of cattle and poultry were exhibited. There were about 1000 ryots present and the best cattle, sheep, goat, dogs, geese and high laying breeds of poultry were given prizes by the Association. Sri V. Nadimuthu Pillai the Local M. L. A., and the Revenue Divisional Officer were among those present on the occasion. The local Assistant Agricultural Demonstrator arranged an agricultural exhibition. The use of various improved agricultural implements were demonstrated and the advantages of using pure departmental strains of paddy, groundnut, ragi, green manure seeds, etc , were explained to the ryots with the aid of attractive charts. Agricultural leaflets were also distributed to the ryots present.

Again from 11—4--40 to 15—4 - 40 a small exhibition was conducted by the local Asst. Agricultural Demonstrator during the Annual Nadiamman Festival at Pattukottai which also proved a great success, Large number of ryots both from the C. M. P. area and the delta of Tanjore and other districts gathered at the exhibition pandal. The exhibits were explained to them and leaflets in Tamil and English were distributed to ryots. A. G.

Samalkota : Conference of Agricultural Officers. The Agricultural Demonstrators of the East and West Godavary districts assembled at the Agricultural Research Station, Samalkota and discussed along with the Farm Staff and the Plant Pathology Assistant, as many as fifty subjects at a conference held from the 8th to 12th inst , under the guidance of Sri N. V. Raghava Rao, Assistant of Agriculture, Rajahmundry and Sri Y. G. Krishna Rao, Deputy Director of Agriculture, I Circle, Cocanada. It may be recalled that a previous conference of the kind, for these Godavary districts, was held in 1930. The conference was very useful for an exchange of ideas amongst the staff, on administrative and technical matters and on local agricultural problems. The farm staff successfully staged an interesting Drama entitled "Krishivala Vijayamu" written by Sri M. Suryanarayana, incorporating in its setting, the latest items of local agricultural improvements.

A paper on "Sugarcane-Retrospect and prospect" was read by Sri G. Satyanarayana member of the farm staff and was discussed.

Sri. U. Tirumal Rao, the plant pathologist of the Division arranged a display of the various bee-keeping appliances and held practical demonstrations, covering a whole day, on bee-keeping and on the methods to be adopted in handling colonies of bees. The Farm Manager, Sri. T. Ragabrahma Rao, got up an exhibition of poultry and farm products and research work on sunnhemp that is being done under I. C. A. R. subsidy.

A day was utilised in field demonstrations and the tackling of farm machinery and equipment, for labour saving purposes. M. S.

Tiruvadi-Exhibition. A large scale Agricultural Exhibition was held in the Central High School premises at Tiruvadi, between 23rd and 26th April 1940 during Sapthasthanam festival. The Tanjore District Board, the Co-operative Milk Supply Union, Tanjore and the South Indian Nursery, Kumbakonam were prominent among others who co-operated. There was a large crowd of visitors, estimated at ten thousand. Radio equipment and electric illumination provided an additional attraction. A. G.

Vuyyur-Agricultural and Industrial Exhibition. An exhibition was held from the 9th to 12th April in the premises of the Sugar factory with the kind co-operation of the factory management. The exhibition was opened by the Collector

and was presided over by the Director of Agriculture. Among the various exhibits of agricultural interest were early, medium and late duration sugarcane varieties breed at Coimbatore, high yielding strains in paddy, millets, oil-seeds, cotton, chilli gogu and Virginia tobacco, exhibits for the occasion. Improved implements for tillage and interculture and appliances for disease-control were shown. Attractive posters were a feature. Economical methods of planting manuring, earthing up and wrapping sugarcane, proper methods of irrigating orange gardens, the use of turmeric polisher, grading of eggs, potatoes and rice, seed treatment with fungicides and the use of sprayers and dusting appliances against pests and diseases were demonstrated. Cottage industries were re-presented by Poultry, bee colonies, canned fruit products and preserved fruit juices, leather, woollen and cotton goods of local manufacture, wooden toys, malts and tobacco seed oil and its products. The last item attracted unusual attention. Special lectures were delivered on agricultural subjects and deserving exhibitors were awarded merit certificates. I. S. R.

College and Estate News.

Season. Fairly heavy and continuous showers were received since the 22nd April and till now more than 12 inches of rain have been recorded. They have been useful to the standing crops such as chitrai cholam and sugarcane. As a result of the rains, Coimbatore has the good fortune of having a cool and pleasant weather.

B. Sc. Agricultural Results :— The results of the B. Sc. Agricultural degree examination are published elsewhere in this number.

Visitors :— Sri G. Seshadri, Honorary visitor, and Secretary of the Agricultural Co-operative society, Negapatam visited the college and Research Institute on 22nd April.

Mr. J. P. Navarrette, Agricultural Officer, Mexico, who is on a world tour to study sugarcane and cereals stayed on the estate from 24th to 27th April. He acquainted himself in detail with the research work carried on in the different sections. He also gave an interesting lecture in ihe Freeman hall on the agricultural condition in Mexico and stated that agriculture was being gradually socialized in his country.

A batch of students undergoing Health officers' training led by Dr. R. M Mathew, Professor of Hygiene, Madras Medical College, visited the estate and made particular study of the clean handling of milk and making of butter in the Dairy, preparation of cholam malt, compost making and the working of the activated sludge.

Entomological Society of India (South Indian Branch). A meeting was held on 20th May. Sri. M. C. Cherian was re-elected as President for the year 1940. A short note on *Selepa docilis* a minor pest of brinjals and its parasite *Eupectrus euplexiae* was presented by Sri. M. C. Cherian and Sri. B. Rangiah Pillai. Interesting entomological specimens were also exhibited.

The Fieldmens' Association. On the eve of his retirement, the resident members of the association entertained Mr. S. Gnanaprakasam Pillai, Fieldman of the Paddy Specialists' and the first President of the association, at a dinner on the 12th May.

Correspondence.

To

The Editor, The Madras Agricultural Journal.

Sir,

I shall be very thankful to you if you can enlighten me on the following.

Striga lutea is perhaps one of the commonest and most dangerous weeds on cholam crop. To my knowledge there are only three species of striga namely *striga densiflora*, *striga lutea* and *striga euphrasiodes* which can be distinguished from one another by the colour of corolla and by the number of calyx lobes.

1. Are there any more species of striga affecting economic crops?

2. In circars and Tamil districts, does striga affect sugarcane seriously?

3. What other economic crops besides cholam and sugarcane have been found to be affected by this weed?

4. What other control measures have been devised besides uprooting and destroying the weed? Are there any experiments conducted for the eradication of this weed? If so, on what lines are they being conducted? Which line of these experiments is most promising for further work?

5. Which varieties of cane have been found to be most susceptiable and which are resistant? Are any trials being made to evolve a striga-resistant variety?

6. Is it a common phenomenon that striga is serious only in heavy and medium black cotton soils and not in light loamy and red soils and much less in sandy soils? If so, what may be the reasons for such a phenomenon?

Any literature in connection with this subject may be cited.

Thanking you,
Yours &c.,
K. S. Sastry.

Yedpalli,
April 23, 1940.

REPLY

The Editor, The Madras Agricultural Journal.

Sir,

Query. 1. In the Flora of Madras (Gamble 1924) five species of Striga are described, the distinguishing characters being mainly number of ribs on the calyx and the colour of the corolla. Two of the species, *S. lutea*, Lour. and *S. euphrasiodes*, Benth. are stated as parasitic on cereals and sugarcane; and *S. orobanchoides*, Benth. as a parasite on various plants chiefly, *Lepidagathis* in *Acanthaceae*, *Euphorbia antiquorum* and *Dysophylla*. It is also reported as a parasite on tobacco and legumes. A fourth species, *S. densiflora*, Benth. is described as 'not recorded as a parasite' by Gamble. But Luthra (1921) has observed it as a pest of sugarcane in the Punjab; and in the Annual Report of the Economic Botanist of the Department of Agriculture, Bombay Presidency, for 1937—38, it is recorded as a parasite on *Jowar*. About the fifth species, S. *Masuria*, Benth. no mention is made in the Flora regarding its parasitic qualities.

In the Flora of Tropical Africa, 24 species of Striga are described of which only five are mentioned as parasitic. These are.

1. *S. orobanchoides*, Benth. Parasitic on Indigofera and other legumes, Ipomoea, Euphorbia, etc
2. *S. Rowlandii*, Engl. Parasitic on grasses.

3. S. *Barteri*, Engl. do.
4. S. *hermonthica* Benth. Parasitic on Sorghum, Zea, etc.
5. S. *lutea*, Lour. A parasitic herb.

S. *orobanchoides*, Benth. has been recorded as a parasite on tobacco in Rhodesia.

Query 3. Among the major S. Indian crops, rice, ragi and maize are also observed to be attacked by Striga. Saunders (1933) quotes all the millets including Cumbu and Korra as hosts of S. *lutea*.

Query 4. *Control measures.* In the case of cereals the best method for S. Indian conditions seems to be to systematically and regularly uproot the plants as they appear without allowing them to flower and fruit, and if this is repeated for 3 or 4 seasons it can be finally eradicated. Though the cost of uprooting in a severely infested field may be high in the first year, in subsequent seasons it will be less, so that on the whole the average expenditure on this work will not be uneconomic compared to the loss caused by its attack.

In S. Africa, what is described as a "trap crop' of a short duration susceptible cereal, like early sorghum or Sudan grass is raised, and this is ploughed in and a maize crop is grown after that in the same year. This is reported to be effective in decreasing striga incidence in the succeeding maize crop; and when repeated for a number of years, the trap crop with the striga being ploughed in before the latter develops fruits, the incidence of the parasite is gradually reduced. In Rhodesia, Irungu cholam of Tinnevelly district in S. India has been reported 'as an excellent host of the parasite, *Striga lutea*, and is expected to prove very suitable as a trap crop for controlling the latter'. But many Rhodesian farmers seem to prefer hand cultivation or pulling out to trap-cropping.

The best solution for preventing striga attack is the evolution of varieties resistant to its attack. In sorghum, selections of Kafir resistant to striga attack have been evolved in S. Africa. Among the African collections grown at the Millets Breeding Station, Coimbatore, a variety from Tanganyika was observed to be resistant to striga. This has brown grains. This has been crossed with the local Periamanjal cholam and work is in progress for the isolation of desirable selections with high yield and resistance to striga attack.

Query 6. Heavy infestation of striga has been observed on light loamy and red soils also; and it has been reported to flourish better on lighter types of soils, especially light red sandy ones, in S. Africa also.

Queries 2, 4 and 5 relating to sugarcane were referred to the Government Sugarcane Expert, Imperial Sugarcane Station, Coimbatore, and the information communicated by him is appended below :—

"Our knowledge of striga is limited to the experience gained at the Sugarcane Station alone. The first entry of seeds of striga into our station was through the floods of 1930 from the *vari* (jungle stream) running along the eastern boundary of our farm. Nowadays we occasionally get it through silt and sand carted into our station from the *vari*. The Presence of this weed in our farm was detected only after a couple of years after its entry, when it assumed a fairly serious form. I give below certain experiments which were conducted to eradicate it and the results obtained :—

(a) *Uprooting and burning the plants.* This method was successful only in those cases where it was possible to remove completely before flowering the whole under-ground stem system. The stem being very brittle it is very difficult to do this efficiently in which case activities of the underground stem get intensified and as a result produce a number of shoots in place of the one destroyed. This method was not found practicable.

(b) *Spraying with copper ~~sulphate solution~~.* By spraying the above ground portions of the plant with 3 per cent solution of copper sulphate the above ground portion quickly dried away ; but within a few days new shoots sprang up in the same manner mentioned in item (a) above.

(c) *Spraying with tar emulsion.* This was not an effective treatment.

(d) *Flooding the field.* The fields were flooded and kept miry when there was no crop. The experiment was prematurely dropped as another method was found to be very effective and easy.

(e) The most effective and easy way of eradicating the Pest on our farm is that the striga plants are detected and treated before they begin to flower. Treatment consists in removing the soil round the stem of the plant so as to make a depression, as deep as possible, without breaking the stem. This depression is filled with 8 per cent solution of copper sulphate so as to bring the whole underground stem in contact with the solution as it goes down the soil. The whole plant is killed in one treatment when carefully done. It is by this method that we have been able to stamp out striga from our plots.

Query 5. We have not made a study of varietal resistance to this parasite ; but it is believed that all cultivated canes are susceptible."

The following publications may be referred to with advantage :—

Luthra, J. C.— Striga as a root parasite on Sugarcane, *Agri. J. India.* 16 519—23, 1921.

Rhodesian Farmers— Successful Control of Witchweed. *Rhod. Agric. J.* Vol. 33 (1936), and Vol. 34 (1937.)

Saunders, A. R.— Studies in Phanerogamic Parasitism, with particular reference to *Striga lutea. Lour. Dept. Agri. Union of S. Africa: Sci. Bul.* 128 (1933)

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Yours &c.
G. N. Rangaswami Ayyangar.
M. A. Sankara Ayyar.

Weather Review—APRIL 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	−0·5	7·3
	Calingapatam	0·1	−0·8	4·2
	Vizagapatam	0·0	−0·7	1·8
	Anakapalli*	0·3	−1·0	4·9
	Samalkota*			
	Maruteru*	0·0	−0·4	1·8
	Cocanada	1·4	+0·8	4·3
	Masulipatam	0·1	−0·5	2·9
	Guntur*	0·6	−0·2	4·6
Ceded Dists.	Kurnool	1·4	+0·8	1·5
	Nandyal*	0·0	0·0	0·0
	Hagari*	2·1	+1·2	2·1
	Siruguppa*	1·2	+0·2	1·2
	Bellary	0·9	+0·1	0·9
	Anantapur	0·6	+0·1	0·6
	Rentachintala	0·2		0·3
	Cuddapah	0·2	−0·3	0·6
	Anantharajupet*	0·1	−2·6	1·1
Carnatic	Nellore	2·6	+2·2	3·6
	Madras	0·5	0·0	0·7
	Palur*			
	Tindivanam*	0·9	−0·2	1·4
	Cuddalore	0·6		1·3
Central	Vellore	1·2	+0·2	1·3
	Salem	2·0	+0·2	4·3
	Coimbatore	3·1	+1·7	3·3
	Coimbatore A. C. & R. I.*	3·4	+1·6	3·6
	Trichinopoly	0·8	−0·9	1·2

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·6		0·7
	Aduthurai*	3·4	+2·0	3·5
	Madura	3·7	+1·7	4·3
	Pamban	4·7	+3·1	6·8
	Koilpatti*			
	Palamkottah	4·5	+2·0	4·7
West Coast	Trivandrum	6·9	+2·4	6·9
	Cochin	5·8	+1·1	6·0
	Calicut	0·5	−2·8	0·6
	Pattambi*	3·3	−0·4	3·3
	Taliparamba*			
	Kasargode*	3·7	+1·2	3·7
	Nileshwar*	0·6	−1·1	0·6
	Mangalore	0·7	−0·6	0·7
Mysore and Coorg	Chitaldrug	2·1	+1·2	2·1
	Bangalore	1·7	+0·4	1·7
	Mysore	2·3		2·3
	Mercara	4·9	+2·3	4·9
Hills	Kodaikanal	7·2	+2·9	8·6
	Coonoor			
	Ootacamund*	5·3	+0·3	5·7
	Nanjanad*	4·2	+1·0	4·2

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather Review for April 1940. The weather was generally dry over the peninsula till the 7th of the month, when secondary low pressures derived from the western disturbances traversing upper India caused fairly widespread thunder showers in South East Madras, Malabar and Mysore and scattered thunder showers in South Bombay Deccan, North Madras Coast and West Central Provinces. Rainfall has been in excess in most places except the Circars where it was in defect.

Skies were moderately to heavily clouded in the Madras Presidency, Malabar and North Madras Coast and lightly to moderately clouded in the Konkan, and Madras Deccan. The relative humidity was in excess in Malabar and the Konkan and was in defect in South East Madras. Temperatures were below normal in the Bombay Deccan and Mysore. The highest maximum of 111°F was recorded at Jalgaon on the 10th.

Chief amounts of rainfall.

Hagari	...	2·0″ on the 22nd.
Pamban	...	1·0″ on the 23rd.
Trivandrum	...	3·9″ on the 24th.
Kodaikanal	...	2·4″ on the 25th.
Kasargod	...	2·1″ on the 26th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 4/40.

Absolute Maximum in shade	...	100·3°F.
Absolute Minimum in shade	...	65·0°F.
Mean Maximum in shade	...	95·8°F.
Departure from normal	...	+ 0·2°F.
Mean Minimum in shade	...	72·3°F.
Departure from normal	...	− 0·8°F.
Total rainfall for the month	...	3·44″
Departure from normal	...	+ 1·56
Heaviest fall in 24 hours	...	1·43″
Total number of rainy days	...	5
Mean daily wind velocity	...	1·5 m. p. h.
Departure from normal	...	− 1·1 m. p. h.
Mean humidity at 8 hours	...	69·8%
Departure from normal	...	− 1·3%

Summary. Dry weather prevailed during the 1st week of the month. From the 9th onwards thunder storm activity was felt and thunderstorms were quite frequent from the 22nd onwards. A total fall of 3·44″ was received during the month which was 1·56″ above normal for the month. The heaviest fall of 1·43″ was recorded on the 29th. Day temperatures were slightly above normal. The night temperatures, relative humidity at 8 hours and the mean daily wind velocity were all below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri. V. N. Subbanna Acharya, Agricultural Demonstrator, Bellary is appointed to officiate as Assistant Director of Agriculture, Category 6, Class I, Madras Agricultural Service and is posted to Cuddapah Vice Sri. K. Raghava Acharya granted leave.

Sri. S. N. Chandrasekhara Ayyar, Assistant in Botany section, Coimbatore is appointed to officiate as Lecturer in Botany, Agricultural College, Coimbatore in category 8, class I Madras Agricultural Service Vice Sri. P. S. Jivana Rao on leave.

Subordinate Service.

Appointments.

Sri G. Konda Reddi, approved probationer is appointed as Assistant in Paddy section III grade (new) provisionally substantive without prejudice to his officiating appointment as Upper subordinate in the Agricultural section.

Janab M. Muhammed Obaidullah Shah Sahib, Assistant in Paddy section III grade-new provisionally substantive and officiating upper subordinate Agricultural section in the same grade, is appointed as Upper Subordinate, Agricultural Section.

Transfers.

Name of officers.	From	To
Sri K. Govindan Nambiar,	A. D., on leave	F. M. A. R. S. Nanjanad
Janab K. Soopi Haji Sahib,	Lower subordinate	F. M. A. R. S., Taliparamba
Sri L. Sankarakumar Pillai,	A. D., on leave	A. D., Rasipuram.
„ S. V. Parthasarathy,	Asst. in cotton A. R. S., Guntur.	Offg. Asst. in cotton Coimbatore.
„ A. B. Adisesha Reddy,	A. D., Dharmavaram,	A. D., Alur.
„ N. Raghava Rao,	Offg. Asst. in Entomology	A. D., Vizagapatam Dn.
„ R. Narasimha Acharya.	A. D., in Entomology St. Thomas Mount	Entomology section, Coimbatore undergo a course of training in Mycology section.
„ C. S. Balasubrahmanyam,	Asst. in Entomology, Cuddapah,	Entomology Asst. St. Thomas Mount
„ V. K. Appaji,	F. M., A. R. S , Palur,	A. D. Karur.
„ D. S. Subramaniya Ayyar,	A. D., Nilakottah,	F. M., A. R. S., Palur.
„ K. S. Krishnamurthi,	A. D., (on leave)	A. D., Nilakottah,

Leave.

Name of officers.	Period of leave.
Sri D. Srinivasa Rao, A. D., Narasaraopet.	Declared to have earned leave for 60 days from 2—5—40.
„ L. Neelakantan, Cotton Asst., A. R. S., Koilpatti.	L. a. p. for 1 month from 22—4—40.
„ L. Sankarakumara Pillai, A. D., Rasipuram.	L. a. p. on m. c. for 1 month from 4—5—40
„ C. S. Rajaratnam, A. D., Mycology, Coimbatore.	Extension of l. a. p. for 1 month from 28—4—40.
„ B. S. Narasimham, Asst. Chemistry, Coimbatore.	L. a. p. for 4 weeks from 6—5—40.
„ D. Hanumantha Rao, A. D., Cocanada.	L. a. p. for 1 month from the date of relief.
„ P. L. Narasimham, A. D., Bezwada.	L. a. p. for 1 month from 3—5—40.
„ J. David, A. D., Microtane Section.	L. a. p. for 2 months from 4—5—40.
„ M. K. Gopalan, A. D., Proddathur.	Extension of L a. p. for 1 month from 1—5—40.
„ A. Parameswara Jothi, Asst. A. D., Bhimilipatam.	L. a. p. on m. c. for 6 months from 1—3—40,
„ G. Ramabhadran, Asst. in Millets. A. R S., Koilpatti.	L. a. p. for 6 weeks from 13—5—40.
„ T. V. Rangaswami, Asst. in Cotton, Coimbatore.	L. a. p. for 2½ months from 29—4—40.
„ S. Venkatarama Ayyar, A. D., Sriperambudur.	L. a. p. for 1 month from 14—5—40.
„ J. Suryanarayana, A. D., Gurzala.	L. a. p. for 1 month from the date of relief.
„ N. V. Kalyanasundaram, F. M. Kalahasthi.	L. a. p. for 1 month from 15—5—40.
„ K. Dharmarajulu, Senior Asst. Botanist under I. C. C.	L. a. p. for 6 weeks from the date of relief.
„ V. Ratnaj Rao, A. D., Sulurpet.	L. a. p. for 1 month from 20—5—40.

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EDITORIAL

The Mysore Agricultural Colonisation Scheme. The Government of Mysore have just sanctioned a scheme of land colonisation for her young agricultural graduates. The colony is to be started in the Irwin Canal area where excellent facilities for irrigation exist. The scheme which would cost the Durbar Rs. 20,000 for 10 colonists consists in leasing out to each colonist 115 acres of land for a period of six years and advancing a sum of Rs. 1500 for capital expenditure such as the construction of a farm house and cattle shed, purchase of work animals, implements etc. On the security of the crops raised, another sum of Rs. 500 will be advanced annually towards working expenses but recouped every year as soon as the crops are harvested. If the colonists succeed in their endeavours the land would be transferred to them at the end of six years at a reasonable upset price based on the present market value of the land and the sum recovered in ten equal annual instalments. The colonists who should be agricultural graduates or the products of the state Agricultural School at Hebbal will be selected by a committee under the chairmanship of the Director of Agriculture, Mysore while the working of the colony will be supervised by the manager of the Irwin Canal Farm.

We are aware of some colonisation schemes started in several parts of India, but barring the one in the Punjab, the success which has attended such endeavours has not been of a high order. The Mysore scheme is different from others in several respects and augurs well for the enthusiastic agricultural graduate who has both the educational equipment and the will to carve out his own future. The land to which he sets his foot is fertile and irrigation facilities goods for raising crops like sugarcane, cotton and tobacco which should pay a handsome return. Above all, the terms of the contract are generous and a good future awaits the right type of unemployed agricultural student. The Mysore Government has to be congratulated in undertaking a well-thought out scheme, the success of which appears as assured as that of several other ventures undertaken by the Durbar.

Indian Sugar for Britain. It is a matter for satisfaction that the persistent representations of the Indian Sugar Syndicate and the Indian Sugar Mills Association have brought some relief to the sugar industry of

the country. His Majesty's Government has now communicated to the Government of India an offer from the British ministry of food to purchase 100,000 tons of Indian sugar. It will be recalled that the industry which is now the second largest in India found itself in a perilous position at the close of the last crushing season when it was faced with a surplus of about 400,000 tons of sugar. When in 1937 the Government of India ratified the International Sugar Agreement by which all exports of sugar by sea to countries other than Burma was banned, it was not realised by many that the Indian industry would have to face such a serious problem in the short space of three years. An increase in the area under cane and the prospect of a bumper crop during the ensuing season had greatly added to the difficulties of the situation. The action now taken by the Government of India to restrict the import of Java sugar and lift the ban on Indian exports should have a salutory effect on a nascent industry which was faced at once with the problem of accumulated stocks and an annual production much beyond the needs of the home markets. We trust that the decision of His Majesty's Government to purchase some of the surplus sugar from an empire country is only the first step in a far-sighted policy which will not only save the Indian industry from a distressing situation but also help to conserve the sterling resources of the Empire.

Fruit Introduction, its Problems, and Place in National Wealth. *

By M. BAPINEEDU, B. Sc., (Cornell), M. Sc., (California),

Parliamentary Secretary to the Hon. the Minister for Public Information, Madras.

Introduction. In times gone by, India was known as the garden of the world. But today India is in poverty. Midas starving amidst the heaps of gold, does not afford a greater paradox. Why should there be periodic visits of famine and pestilence in a country where land is fertile, sunshine in plenty, winter injury negligible and the growing season long and favourable for good agriculture? In the utilization of our natural resources lies the real foundation of national prosperity.

Fruits and their place in Indian life. In this land, sages, philosophers and prophets seem to have lived on an exclusive diet of milk and fruit. Even in the present day there are thousands who live chiefly on fruits. On religious days many confine their diet to fruits. At weddings and temple worship fruit is indispensable. If anyone visits a friend, a relative or an officer it is a common custom to make an offering of fruit. Fruit is a cosmopolitan food. With fruit, a natural food, there is no distinction of caste or creed. The average meal in India is incomplete without pickles or chutneys, products of fruits and vegetables. A poor labourer is satisfied if some pickle is added to his meagre meal. Orange and lime juice have become indispensable in enteric and other ailments. In a hot country like ours fruit juices must be in greater demand than aerated waters. Coconut milk is already a popular beverage that is both refreshing and healthy. The fruit juices must be similarly popularised, so that their consumption may become a natural habit. We should have as our ultimate object and motto, a fruit a day for every man and woman of all ages and classes. Our fruits fresh, dried and canned, should easily find ready markets in European and other foreign markets.

Present Production and trade. As against all these immense possiblities for expansion of the fruit industry we are today actually faced with a position that is at once alarming from the national health point of view and ruinous from the view point of national economy.

The Departmental marketing surveys have shown that, we have now a total area of a little over 400,000 acres planted to fruits. Mangoes with 240,652 acres, bananas with 142,140 acres, oranges and limes with 21,000 acres form the main commercial fruits. Grapes (250 acres), pineapples (350 acres) and pears (500 acres) are the next in importance. Cashewnut

* Summary of paper read at the 28th Annual Conference of the Madras Agricultural Students' Union held in July 1939

is another important commercial product under fruits and nuts and is the only exportable commodity at present, accounting roughly for 8,000 tons of kernels per year. Fruits like guavas, custard apples and sapotas have not been surveyed. However, it has been estimated that the orchard value of all fruit crops at present in the Province is to the tune of Rs, 5,00,00,000. Of this apparently vast production, the exports to other provinces account for only a small quantity of mainly 564,000 mds. of mangoes, 2,50,000 mds. of bananas, 117,000 mds. of pineapples, 25,000 mds. of limes and very small quantities of pears and grapes of the aggregate value of about Rs. 2,171,000 per year. On the other hand, we actually import fruits of the value of Rs. 162,000—grapes worth Rs. 1,27,000 oranges worth Rs. 492,000 pineapples of the value of Rs. 12,000 and limes of the value of Rs. 5,000 per year, making a total of Rs. 798,000 leaving a favourable net export balance of only Rs. 1,373,00 per annum of fresh fruits. Cashewnut exports also account to a total export value of about Rs. 10 lakhs per year. But this is not all the story. This country is a large importer of canned fruits and fruit products and is likely to depend more and more on foreign supplies in future, if no steps are taken to prevent such a state of affairs. At present India imports annually about Rs. 11,00,000 worth of canned and bottled fruits, of which this presidency alone takes about Rs. 2,00,000 per year. Imports of jams and jellies to India are of the annual value of about Rs. 7,00,000 of which Madras accounts for about Rs. 1,00,000. During 1937–38 imports of confectionery were of the value of Rs. 18,79, 891; pickles, chutneys, sauces and condiments Rs. 6,21,675, and vinegar Rs. 20,931. Besids these there are still, the fruit juices and beverages, fruit essences and artificial or synthetic fruit drinks, for which no reliable figures are available.

Opportunities neglected. With the immense diversity of soil and climatic conditions, this country assuredly offers very vast possibilities for the production of the choicest varieties of almost every fruit known to the world. India is recognised to be the original home of a number of fruits which are now grown extensively in other parts of the world. In fact, the fruit industry in this country has assumed such an anamolous position that, it has now become a necessity to re-introduce from abroad the selected varieties of these very fruits which once were our country's pride. The famous Washington Navel of the New world, Australia, and Africa were according to some authorities originally introduced from the Eastern part of India. The famous lemon industry which has now become the chief source of citrus beverage is recognised to have its original home at the foot of the Himalayas. But to-day we take pride in having a few stray imported trees of these fruits in some of our gardens as mere local curiosities. What a commentary on our inertia! Even in the case of mangoes of which we hold almost a monopoly of production, we look to a Wilson Popene of the United States for the essential technical information on its culture. While the United States of America has undertaken systematic hybridisation on this

fruit, we in this province have just commenced planning a few preliminary experiments on this crop only during the past five years.

As one of the most important of the rural industries and as one of the main sources of our national health and wealth, fruit deserves much greater attention than has been given to it in past. Fruit research has been almost badly neglected for so long a time by the state, that we are just where we were about a century ago. It was formerly considered that tea, coffee and such other non-fruit plantation industries merited our attention more than fruit culture whose development was essential both for national economy and national health. While South Africa and Australia built up a flourishing export trade in fruits, which became a main source of wealth to the British settlers of those countries, the fruit industry in India was left in a static condition. Even the few enthusiasts who wished to work in the line were discouraged and accorded no facilities. The histroy of the gigantic expansion of fruit growing industries in Palestine and Brazil during a short space of two or three decades and of the canning industry in Hawai to the present state of being the leading industry of the islands are all matters of recent history which clearly demonstrate to us the enormous scope of extension possible in this country if due encouragement and guidance are given.

Fruit Introduction: Some notable results therefrom. Among a large number of methods open for improving the fruit industry I shall confine myself to-day to only one aspect, namely fruit introductions. The epoch making developments that have resulted in other parts of the world by fruit introductions serve to emphasize the value of such work in the present stage of our development. The romantic history of the introduction of Washington Navel orange in California in 1870 by one William Saunders, Superintendent of the Gardens in Washington, which has resulted in the growth of the Californian Citrus Industry to the present day annual farm value of 135 million dollars, is an outstanding instance in point. It has been aptly said that the introduction of the original batch of two trees of this variety into California proved as important in Californian history as the discovery of gold. Nay, this discovery was far more important than that of the precious metal, for this fruit has not only come to be recognized as the second most important exportable produce of California, but has also given continuous work to millions of people; but what is still more important, it is an all-important source of valuable vitamins of dietetic value which has improved the health and happiness of the peoples both of United States and a number of foreign nations.

An enquiry into the origin of the cultivated fruits discloses the fact that there were three distinct centres from which the migration has taken place in more than one direction. These were distributed in the three continents, two in the old world, Asia and Europe, and one in the New.

Old World.:—1. Southerneastern Asia—including China, India and Malay Archipelago. The fruits indigenous to those regions are as follows.

Sweet orange, mandarin, common jujube, apricot, peach, Kaki, litchi, citron, bitter orange, Indian jujube, mango, jak, dwarf-date, banana, coconut, lemon, lime and grapefruit. 2. Temperate Europe and Asia—caucasian region. Raspberry, Strawberry, almond, pear, pomegranate, gooseberry, olive, fig, pistachio, walnut, date, plum and apple.

New World. Tropical America. Pineapple, anonaceous fruits, cashew-nut, guava, pumpkin, sapodilla, avocado, tomato and cactus.

It is very significant and suggestive to correlate these regions with the centres of ancient civilization. The constant mingling of races and the consequent intercourse with other countries broke these centres, and as a result most of the fruits have become quite cosmopolitan. Take for instance the sweet orange, which is indigenous to Cochin China. It is sold in every country store in the United States and is cultivated at its best, in largest acreage in California, which is at the other end of the world.

Fruit Introduction in India and abroad. The introduction of fruits is popularly considered to be the job of a novice. This belief is based on an utter ignorance of the importance of this work. Fruit introduction as carried out in this country by amateurs has led to an enormous waste of national energy and wealth although it must be admitted that it has also conferred a few benefits.

The famous blood red orange of the Punjab introduced by a medical man, the Batavian orange of the Circars and the Mozambique oranges of Bombay and of Central Provinces possibly imported by the Dutch and the Portuguese settlers are instances of private enterprise, which have developed into large scale commerical industries in a short space of time. In a lesser way we have the grape growing industry near Kodaikanal Road and the Manilla orange in the Courtallam area, both of which go further to emphasize the value of foreign fruit introductions, but at what cost ?. Innumerable plants have been obtained from elsewhere and planted by growers in every part of India, only to prove a source of utter disappointment to the growers after some years. Let me give an illustration. Everyone of us knows that Jahangir is one of our choicest mango varieties. This variety, however, is known to be a very shy-bearer, so much so, that it has no place in a commercial garden. Despite this fact some nurserymen advertise it and offer it at fanciful prices. The unwary grower, in the belief that the variety would truly be an acquisition may plant a large area, which ultimately is found to lead to an economic loss. Similarly, the famous Washington Navel orange has been introduced in large numbers in all parts of India at considerable expense, but has not yet proved superior to our local oranges either in yield or quality. Yet nursery men are still selling to the public hundreds of plants of this variety. There are still more instances of persons introducing into the tropical plains of the Presidency such plants of the temperate regions like apples, peaches and plums. All such activities may bespeak of the grower's enthusiasm but hardly do credit to his horticultural intelligence or experience.

In contrast to this, let us compare the methods adopted in a country like U. S. A. There the first step in plant introduction is the exploration. It is the trained explorer who first goes out in search of the fruits; fruits that are new or those that are of value for breeding work. He studies the natural habitats and the peculiar growth and fruiting habits of every fruit tree he comes across. Being fully conversant with the conditions of his native home, he is able to pick out those of possible value and send them over to the Plant Introduction Office.

The galaxy of such world famous fruit explorers sent out by the United States Federal Department of Agriculture like David Fair-child, Wilson Popence, P. H. Dorset, W. T. Swingle, and Frank Mayer have truly contributed inestimable wealth and happiness to the States and have inspired the research workers and fruit growers all over the world. Even the private nurserymen of America have contributed no mean share in the enrichment of the fruit wealth of their country. Which of the prominent citrus growers in the world do not remember with silent gratitude the name of Charles Volz, a Californian nurseryman who was responsible for the introduction of sour orange and demonstrating its value as a rootstock for sweet oranges ? The value of this discovery alone is evidenced from the fact that, about 75 per cent of citrus trees grown in the world are to-day worked on the sour orange rootstock. Even so, the gigantic expansion of the fruit industry in the New World owes not a little to the fruit introductions and varietal trials carried out by two Florida nursery men, George Ludley and E. Reasoner.

The Plant introduction Bureau in America is a special organisation which identifies the plants introduced, tests them under controlled conditions at select centres, studies their peculiarities and requirements and finally selects those which are promising for large-scale tests. It is only after the large scale tests are completed, that plants are distributed to the public for commercial planting.

In the initial stages, however, the private nurserymen of India have also undoubtedly contributed much for the enrichment of the fruit wealth of this country. But it must be remembered however, that our fruit nurserymen are of a stamp quite different from the class one usually comes across in foreign countries. Poverty and lack of state help and scientific training have prevented the Indian grower and nurseryman from playing his legitimate part in the development of the Indian fruit industry. It is true that even in more advanced countries of the west, the nurserymen usually play only a secondary part in plant introduction, but in this country the state has necessarily to bear the full burden. In reality however, it has been the other way round, till very recently. We owe most of the little improvements in the fruit industry of this presidency to private enterprise, and not to the state. The origin of several thousands of acres under mangoes, primarily under such varieties as *Chinnaswarnarekha* of the Circars, *Mundappa* of the West Coast, *Jahangir*, *Imampasand*, *Allampur*, *Baneshan* and a number of *rasams* of the Andhra Desha and the *Vadlapudi* orange of the same tract

are all traceable to certain individuals who had the love and foresight of the pioneer. These and various other unrecorded instances prove the value of such work in the nation's progress. The glory of the work of these various benefactors to the human health and prosperity remain unrecognized in contrast to the reverence paid to such discoverers in other parts of the world.

Limiting factors in fruit culture. Of the four important limiting factors—moisture, soil, light and temperature, the fruit grower can modify the first two by irrigation and use of fertilizers but he cannot change light and temperature. It is universally admitted that temperature is the most important factor in determining the flora and the vegetating zones of different places, particularly in the distribution of food crop sections of the world. Temperature has a direct bearing upon fruit growing. Gardener, Bradford and Hooker thus summarise the influences of temperature.

1. It delimits zones beyond which the growing of specific fruit becomes commercially hazardous becase of lower winter temperature.

2. It delimits zones beyond which the growth of certain fruits becomes unprofitable because of high temperature.

3. Makes certain areas unprofitable for some fruits because of low summer temperature.

4. Turns good land to that of doubtful value for several fruits because of danger from spring frosts.

5. Within areas ordinarily safe for growing certain specific fruits an occasional deviation from normal may cause considerable damage.

6. Some insects and diseases are more or less dependent on proper temperature for their optimum development.

Heat is such an important factor that the fruit zones of the world which correspond to the life zones of meridian 34 are determined by the total units of temperature.

This is a broad and general division of fruit zones. Different varieties of the same fruit differ in their range of temperature. The same variety is not successful in the different tracts under the same climatic zones. That the same varieties of apple, grape, date, orange and peach grown in the similar crop zones are not uniform in their quality, is well known. The Washington navel orange is not successful in Florida, while the California grapefruit is inferior to that of Florida. Some of the non-astringent Japanese persimmons develop astringency in California though grown under apparently similar soil conditions as those found in Florida.

Moisture:— This plays an important role in fruit introduction. Moisture means rainfall, its time and the amount and also the relative humidity. Irrigation may make up for the insufficient rainfall but humidity and the time of rainfall limit the fruit production. The time of rain is closely related to successful fruit production. Rains during the blooming and fruiting period are detrimental to the pollination and ripening of fruit. The

possible effects are (1) bees will not work on a cloudy and rainy day, (2) stigmatic fluid becomes thin, (3) pollen may be washed away or anthers may burst, (4) the maturity of the fruit may be delayed and (5) splitting and souring may occur. Water has its own influence upon the yield, size, colour and composition of the fruit.

Light:— Light affects plants in intensity, quality and duration of exposure. It affects the flowering, fruiting and the quality of fruit. Fruit on the outside of the tree and fully exposed to light is inferior and often ruined, while the fruit screened by foliage is of the finest quality. Duration of light is very effective in the metabolic processes and carbohydrate formation. The longer the duration of light, the higher is the amount of plant food manufactured. The length of day is unique in its action on sexual reproduction. The blossoming and fruiting of a species may depend on whether the length of day in a new region is favourable or unfavourable.

Wind. This has injurious effects upon the tree and the fruit. The stems and branches bend away from the normal direction of growth and finally break. High winds during the fruiting season destroy the whole crop by stripping the fruit from the tree. Wind interferes with the pollination as the insects are not active in a strong wind. Wind location should be observed in locating the orchard site. Wind prevents the germination of pollen grain.

Soils. Fortunately most of the fruits are not exact in the soil requirements. Fertilizers and manures may correct the soil defects. Hard pans and too acid or alkaline soils should be avoided. Elevation, texture of soil, presence of forest trees as wind breaks, all enter into local climate of the orchard site.

Plant Diseases. In introducing a new plant, one should take extreme precaution in preventing the entrance of any pest or disease with it.

What the Government is doing. The importance of research work on fruits came into prominence in this country as a result of the post-war depression in agricultural prices. The Royal Commission on Agriculture has clearly emphasised the importance of fruit development. This recommendation has since achieved greater importance as a result of the work of nutrition experts. All these factors were responsible for the new orientation in the policy of the Imperial Council of Agricultural Research who have now sanctioned a number of fruit research schemes in different parts of India. With the starting of one of these schemes at Kodur in Cuddapah district the work of fruit introductions and variety trials naturally loomed large in the activities of this station. At present the station possesses valuable collection of over 100 reputed varieties of mangoes from all over India, Burma, Ceylon and Phillipines, and a still more vast collection of all the reputed varieties of citrus and those of lesser importance that are indigenous to this country. In fact, the collection has already attracted the attention of workers abroad, who have sought the help of the station to

introduce some of these varieties in their respective countries. While this collection will be a valuable source of selecting the varieties according to regional needs and according to the local fancies and prejudices of the growers and the consumers, it will also prove to be a valuable material for pursuing the hybridization work in future. It is regrettable that sufficient funds and facilities have not been provided for augmenting this collection and for starting similar variety collection centres in other representative tracts of this province. I am convinced that such stations are urgently required to be opened at Kodaikanal, for the hill fruits, in the agency tracts of the Circars for fruits suited to the humid regions and also perhaps in the Tamil districts for increasing the fruit wealth in that part of the province. Certain fruits of temperate regions have been introduced on the Nilgiris at different times but perhaps not entirely in a systematic manner. The work that has been done on the Nilgiris is not likely to be of practical value to the Kodaikanals. The most important tracts have been suggested but it is possible to multiply the fruit stations by selecting other tracts also, such as the Shevaroys, Lower Palani hills, Curtalam area and the Wynaad tract of the west coast.

Fruits that can be introduced. It needs no emphasis to be told that this Presidency has multiplicity of conditions which favour the profitable cultivation of many fruits. The dry and hot weather conditions prevailing in the Ceded Districts afford a vast scope for the introduction of choice varieties of dates, a crop which has contributed so much wealth to countries like Iraq, Egypt, some portions of South Africa and United States of America, possessing similar environmental conditions. The rain-fed tracts of the Circars agency, lower Palni Hills and Wynaad of the West Coast already grow excellent varieties of loose jacket oranges, and I see immense scope for developing these industries by the importations of better varieties. Even in the uncultivated forest areas, possibilities exist for the development of cultivaton of vast number of profitable varieties of fruits like zizyphus, custard apple, jak and perhaps some choice types of mangosteens also. There are yet other types of fruits like persimmons, litchees, rambhutan, durrian, avocadoes etc. which can find a number of congenial places in the presidency. The last mentioned fruit, has a protein content, which is about 2 per cent higher than that in other fruits. Temperature does not seem to limit the development of the avocado industry in S. India. The avocado is a boon to vegetarians. It takes the place of meat. Add an avocado to each meal of an average labourer and it would certainly change his constitution. It is an excellent diet in wasting diseases such as tuberculosis, and a blessing to victims of diabetes, diseases very common in India.

Fruit introduction is only one aspect of the complicated problem in the improvement of fruit industry in this province. Nevertheless, it is an important aspect, particularly so in the initial stages of fruit researh in a country like India. Selection of trees of outstanding merits, controlled hybridization and investigations into the improvements of propagations and

orchard practices as well as effective control of fruit diseases and pests are other important problems that cry for solution. Above all, we have yet to commence intensive investigations into the fruit canning and fruit by-products manufacture. This has specially become very important at the present age when frequent gluts and low prices have given a set back to the fruit growing industry. Unless means are devised for diverting the surplus produce into a profitable outlet as the fruit canning factory, one can never guarantee reasonable returns to the growers nor can one hope to meet the increasing demands for canned and preserved fruits in this country. I immediate action is not taken in this matter not only the fruit industry stands to suffer but eventually a stage will be reached when it will become impossible to oust the foreign products from our internal markets.

Transport of fruit is another serious problem that requires immediate attention. In this case it is very necessary that detailed investigation should be undertaken in the cold or gas storage of fruits so as to determine the maximum period of storage life and the optimum storage temperatures during transport for each and every commercial variety of fruit. At least one cold storage plant at Madras and another at an important growing centre like Kodur appear to me to be urgently required for tackling this problem. It must, however be pointed out that the improvement of transport of fresh fruit is limited by the prevailing rules and regulations of the railway companies over whom we have no control.

An Appeal and an Assurance. In conclusion let me explain to you what the present Government of this province stands for and how it is striving to materially improve the lot of the rural classes. As a nation dwells in the village, the rural problems occupy the first and best of our attention. Debt Relief Act, Prohibition, Land Laws (Tenacy Reforms), Cloth Bill; and National Planning or Industrial Revival are the order of the day. As students of Agriculture we must look ahead with a broad vision and find ways and means to improve our national wealth. Improving the present crops, introduction of new crops and getting better prices for the peasant's produce are some of the ways in this direction. In this work the Government expects every one of you to extend to it your hearty co-operation. As Confucius has said "The well being of a people is like a tree; agriculture is its root; manufacture and commerce are its branches. Break these away and the tree dies". The present Government cares for the tree, for its every limb and parts thereof. The fruit industry which is one of the important limbs can depend upon the government to have its interest well-protected and well nursed by every means in its power.

The Wax Beetle—*Platybolium Alvearium*, B in South India.

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Introduction. In August 1937 specimens of a Tenebrionid beetle found inside the hives of the Indian honey bee in Coimbatore were sent to the Imperial Institute of Entomology, London, for identification. On examination it was found to be a new genus and Blair (1938) has described it under the caption *A new genus and species of Tensebrionid beetle in bee hives in India*. In the concluding paragraph of his note he has called for more precise observations as to the status of the beetle in the hive. A study was therefore made of the beetle with special reference to its status and this paper gives information on the observations made so far.

Description of Adult. Blair has described the beetle as follows :—

"Rather more than twice as long as wide, dark castaneous, rugose-punctate above. Eyes above obliquely transverse, canthus as wide as lateral length of eye ; frons densely rugose-punctate and raised in a small elevation above each eye; clypeus more finely and sparingly punctate ; antennae with third joint scarcely longer than its apical width, fourth wider and strongly transverse, fifth to eleventh yet wider, subequal in width, set with large deep punctures interspersed with fine setigerous punctures. Thorax rugosely, punctate throughout, the expanded margins redder than the disc. Elytra each with nine carinae, the eighth and ninth abbreviated about the level of the base of the last abdominal segment, the fifth at about the same level, the fourth and sixth usually uniting behind it ; intervals between carinae densely punctate, but less coarsely and closely than the thorax, obscuring the striae. Under side more shining than above and except on the prosternum, finely and more sparsely punctate. Length 5·6 mm."

From the external appearance of the beetle it is not possible to distinguish the sexes.

Ghosh (1936) mentions a beetle—*Bradymerus* sp. found in the hives of the Indian bee. According to him, the beetle and its grubs infest the combs and are quite at home with the bees in the hive. Further, he states that the beetles eat the combs especially somewhat old ones. As named specimens of the beetle are not available in the Coimbatore collections it is not possible to say whether *Bradymerus* sp. mentioned by Mr. Ghosh is the same as *Platybolium alvearium* or not.

Life History. *Eggs :* Eggs are laid in groups in crevices between the brood chamber and the base board or between the super and the brood chamber. The maximum of such groups was observed to be 13 and the minimum 3. The egg is white, smooth and shiny and elliptical in shape. It is just over 1 mm. long and about 0·25 mm. broad. The incubation period is from 4 to 5 days. The beetles are sparse egg layers and take long intervals for laying eggs.

Grubs. Soon after hatching the grubs scatter themselves in various directions and begin to feed upon the wax particles on the floor board. The newly hatched grub is about 2 mm. long and 0.2 mm. broad. The head capsule is coppery in color and the remaining portion of the body pale white. The full growm larva is 11 mm. in length and 1.5 mm. in diameter and yellowish red in color. The head capsule is much narrower than the body and deeply coppery, the mandibles being brown. The body is only slightly hairy but hairs are long and pale white in color. The whole larva is more or less cylindrical. Generally the grubs are seen very close to the portions of the floor board where the brood chamber rests. The larval period is pretty long and varies from 103 to 120 days, the average being 112 days. All these grubs were fed with the normal food (particles of wax, etc., found on the floor board). The grubs when fed with pollen removed from the food materials stocked in combs were found to thrive better than on wax and such grubs looked better and healthier than those fed on wax and the development was also much more rapid. Such larvae were observed to have attained the pupal stage in the course of 36 to 42 days the average being 39 days.

Pupae. The larva, two days before pupation, is found to be inactive. The pupa is 6 mm. long and 2.5 mm. wide. It is pale yellow in color when first formed but undergoes changes of coloration and on the 5th day becomes coppery in color. The pronotum is highly prominent with a number of short hairs. The femora and tibia of the front and middle legs are visible over the elytra whereas those of the hind legs are locked under them The apex of the abdomen has two pairs of spines, one curved upwards and the other almost straight and shorter than the first. The dorsae surface of the pupa is smooth; the ventral surface has a number of short hairs. The pupal period lasts 6—7 days. The total life cycle varies from 113 to 132 days in the case of larvae fed with normal food and 46 to 54 days in the case of larvae fed with pollen only.

Longevity of Adults. The adult beetles fed with normal food (wax) live for a longer period varying from 100 to to 180 days, the average being 148 days. They were also fed with pollen; among such adults the longevity was reduced and the average life was only 43 days. Adults when fed with cholam powder did not live for more than a month. Adults without food did not survive for more than 18 days.

The Nature and Extent of Damage. It has already been mentioned that the beetle grubs breed mainly in the particles of combs and powdery matter on the floor board. The grubs therefore do not actually attack the combs. The beetles are seen on the grooves of the brood chamber as well as those of supers where frames rest. They feed on the combs and bore into the cells. When they remain motionless in such places they will very often be overlooked due to their color which resembles that of the old combs coated with propolis.

The extent of damage done by the beetle varies depending on the number of beetles found. Though found practically throughout the year they are not observed in large numbers and in a strong colony very little damage is done by the adults. In weak colonies and in hives without bees the beetles do some damage by feeding on the combs. As a result of examination of large number of hives the authors have come to the conclusion that *Platybolium* should be considered only as a minor pest of the bee colonies though it is capable of doing some damage to stored combs and those kept in hives without bees.

Control Measures. Hives should be examined regularly once a week and the eggs, grubs and pupae destroyed by cleaning the floor board thoroughly by means of a brush or by wiping it with a piece of cloth. The beetles can also be handpicked without difficulty and destroyed.

Acknowledgment. The authors have great pleasure in thanking the Imperial Institute of Entomology, London, for kindly identifying the beetle.

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A Survey of Fruit Cultivation in Kadayam.

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Introduction. The importance of fruit as an integral part of our daily food has been of late increasingly recognised for their rich vitamin content and their therapeutic and prophylactic properties. The researches of Col. McCarrison and Dr. Akroyd, have proved the notoriously poor quality of the average South Indian diet and roused us from our apathy towards the dangers of malnutrition. These nutrition experts have recommended eating of more fruits as a panacea for all the prevailing deficiency diseases. The Government are alive to the demands of the situation and have started a campaign of "Grow more fruits". Attempts in this direction consist, not only in exploring the possibilities of fruit cultivation in the plains wherever facilities exist, but also in helping the fruit industry in places where it is in a nascent condition, or in a languishing state. The fruit growing area in and around Kadayam in the Tirunelveli District comes under the last category. With a view to suggest measures to resuscitate the industry to a profitable level, a preliminery survey of the tract was done in January 1939. This paper deals with the study of the present fruit growing conditions in this region and the possible lines of improvement.

Situation and nature of the tract. The Kadayam tract which lies to the North-west of Tirunelveli District is favourably situated in the orbit of the two monsoons. The annual rainfall is 38 inches on an average; 25 inches of which are received during the North-east monsoon; 8 inches during the South-west monsoon and the rest during the hot weather months. The climate is equable, the well water is free from injurious salts and is good for orchard irrigation. The soil is well drained. It is red gravelly in nature with sand sparsely mixed. The depth of the soil varies from 3 to 6 feet. Apart from nature's bounties, which are available in abundance for fruit cultivation, the tract enjoys easy access to the neighbouring urban markets through railways and excellent roads.

Fruit cultivation in the tract. Taking advantage of the favourable conditions a few enterprising landowners started lime cultivation in small areas 30 years ago. Their pioneering attempt met with signal success. Not only the area under limes has expanded to the extent of 200 acres at present, but the fruits of the tract have also captured the Trivandrum, Quilon and Cochin markets and hold almost a monopoly over them. The tract exports about 50,000 maunds of limes annually to the above markets. Lime is the only fruit of commercial importance in this area and is grown in holdings varying from 20 cents to 6 acres, spread over about 100 gardens. Next to acid-lime, tight jacket orange is a most popular citrus variety occupying 30 acres in Katlamalai Estate lying in the environs of Kadayam. These find a sale in the local markets. The third important fruit crop is the

plantain. *Nattu Vazhai* and *Kathali* are two important varieties grown for local consumption in about 460 acres distributed over the whole area. The former variety occupies a larger area and is cheaper. The latter is better relished on account of its flavour and fetches a higher price of 2 to 4 annas per bunch. Mangoes are also cultivated in about 131 acres spread over small holdings varying from 20 cents to an acre. The popular varieties grown are *Neelam, Bangalora, Mulgova, Banganapalli* and *Dwarf Mulgova*. In addition, a good number of country varieties are being cultivated despite their poor quality and low yields. The total output of mangoes is on the whole poor for the area grown and inadequate for local consumption. Therefore large quantities of this commodity are being imported every year to satisfy the local demand. Of the other fruit varieties grown, mention may be made of the new introductions that bid fair to be successful are jack, Kamala oranges, sapotas, pineapple, pomegranates and grapes. These are grown in isolated patches in the midst of commercial fruit crops amounting on the whole to about 30 acres. Though these are foreign to the tract they come up vigorously and yield well. The possibilities of growing these varieties successfully on a commercial scale is evident from their excellent adaptability to the changed environments.

Methods of Cultivation. The chief commercial fruit crop of the tract being acid-lime, the methods of cultivation followed for this are briefly mentioned below. The plantations are started with seedlings preferably two years old. The spacings adopted vary to a great extent from 12 to 25 feet between plants. No inter crops are raised usually. Basin irrigation is commonly followed. The plants are watered up to the base of the stem. Such a method is construed to be unsuitable, if not injurious to growth and aeration of the roots. The frequency and depth of irrigation also vary from garden to garden, irrespective of the optimum water requirements of the crop.

Manuring. Regular manuring of the plants is done from the time they start bearing. The manures are applied in two doses. The first dose which consists of 5 to 10 baskets of cattle manure per plant is applied in June—July about the close of the fruiting period. The second dose is given in December—January in the form of green leaf manure at one head-load per plant. Kolingi, Avarai, and Vagai are the chief green leaf manures. The use of artificials as manure is rather rare though it seems to have a promising future. One Mr. K. K. Lakshiminarayana Iyer of Kadayam tried bone meal at 10 lb per plant in conjunction with 75 lb of green leaf manure and obtained 5 per cent more yield per plant over the control.

Fruting Period. The trees begin to bear from the third year of the planting. But from the 8th to 25th year peak productions are usually obtained ; each tree gives about 4000 fruits per year.

Diseases. The common diseases prevalent in these orchards especially on limes, are canker, gummosis and die-back. But no serious attempt

has so far been made to apply suitable remedial measures to control their spread.

Marketing. Nearly 85 per cent of the limes produced are exported by rail to Trivandrum, Quilon, Kottarakara, Tuticorin, Punalur, Tiruchendur Nagarcoil, Marthandam and even to the far off towns like Virudhunagar, Trichinopoly and Madura. The rest of the produce, which is transported to the neighbouring shandies and towns by carts and buses finds easy sale there. Marketing is done by contractors and local merchants who take the produce on lease from these gardens. In this connection it should be, mentioned that a Co-operative Society started in this centre for marketing of fruits has not been functioning satisfactorilly owing to the unhealthy competition set up by the middlemen and merchants among the fruit growers. The following table gives the quantities of lime fruits exported during the several months of the year 1938.

Monthly movements of limes from Kadayam.

Months.	*Quantity in Maunds of* 82$\frac{2}{7}$ lb.
January	6350
February	1900
March	3000
April	2750
May	5080
June	4070
July	4300
August	2900
September	1800
October	2650
November	4150
December	6000

Financial returns. As in many other agricultural commodities the depression has of late affected the lime industry. The fall in the market price is nearly 50 per cent which can be judged from the fact that the present rental value per acre is only Rs. 500/- as against Rs. 1000/— in the last decade. Apart from the agricultural depression other contributory causes for the low ebb of the industry is the lack of organisation between the growers for efficient marketing; nor have they made any serious attempt to adopt improved and systematic methods of cultivation to compensate the diminished returns, through increased production and reduction in the cost of cultivation One more reason which is of recent origin is the serious competition of lime fruits from Ayyampalayam and Kannivadi tracts of Madura District in the Trivandrum and Quilon markets. In the above tract limes are raised under rainfed conditions on the hill slopes in and around Kannivadi. The fruits from the above regions are therefore available at much cheaper prices. Further in the Travancore markets the demand for limes is low during the rainy months which coincides with a heavy production in the Kadayam tract and elsewhere. The scope for alternative markets during periods of heavy production has not been explored and glut prevails everywhere.

Suggested methods of improvements. *Selection.* From the survey of the fruit cultivation in this region it is evident that the present state of the industry needs improvement over a wide range, from the selection and cultivation methods to that of marketing of the produce. The first and foremost attempt should be to replace the existing varieties which are uneconomic and of an unknown or doubtful pedigree by those of outstanding merit. A number of exotic varieties of repute must be introduced for trials in this tract and the most suitable and consecutively high yielding types should be propagated. Increased production through improved varieties could to a great extent make up for the fall in the income of the fruit grower.

Varietal cropping. It is not sound economics to stake all the investment upon one variety such as the acid-lime when fair prices are not assured for many months in the year. It is desirable to grow in addition a number of other varieties of fruits such as Cheeni oranges from Kodur, pomeloes, sapotas, jak, pomegranates, grapes etc. which can provide the grower with continuous and regular income all through the year. In other words the first grower should allocate the area under various fruits suitably to get an economic and continuous income all the year round instead of sticking on to lime growing alone.

Off-season bearing types. Some of the valuable forms of off-season types can be grown with success in addition to early, middle and late season varieties for getting a continuous supply of fruits over a long period with profit. In one garden belonging to Mr. A. V. Subramania Mudaliar at Alwarkuricei a few off-season bearing varieties are being grown and they are found to fetch a good income.

Selection in the nursery state. In selecting acclamatized and reputed varieties for the plantations rigourous elimination of the plants which are poor in growth and susceptible to the diseases must be made. This will ensure starting of the orchard with vigorous and consecutively heavy yielding types.

Cultural practices. The cultural practices followed are crude and unsystematised. The same methods are followed irrespective of the habits of the varieties. The spacings given to the fruit trees are either too close or too far with no uniformity for particular varieties. Standardised methods of spacing necessary for each variety should be followed to produce the maximum yields. In this tract it would be suitable and economical to have 20 feet spacing for acid-limes and pomegranates, 30 feet for oranges and up to 40 feet for mangoes In addition planting of trees in lines by adopting the square system or quincunx method would be more advantageous.

Manuring. The system of manuring followed is not specialised with reference to the requirements of each variety. A judicious system of manuring suitable for each crop with profitable use of artificials wherever possible should be inculcated.

Irrigation. The method of irrigation practised is neither economical nor quite beneficial to the plants. Ring irrigation should be practised by virtue of which shallow basins round the plants must be widened leaving a bund round the basal portion of the stem, so that irrigation water may not reach the trunk. The present method of shallow irrigations at frequent intervals can be replaced by copious irrigations at longer intervals

Application of remedial measures for the common diseases. The trees should be periodically examined for any pests and diseases. As a preventive measure against the spread of any disease the affected or dead portions must be pruned off. In orange and lime gardens it is essential to remove periodically water shoots and dead branches. Whenever any disease appears, standard remedial measures should be immediately adopted to check their spread. Of the diseases on lime in this tract 'canker' is a serious one. It is characterised by yellow mottled patches and brown corky spots on the leaves, tenderstems and fruits. In severe cases it gives a scabby appearance to the fruit and makes it less attractive for the market. The juice content of the fruit is also reduced. Pruning and spraying with Bordeaux mixture has been found to be an effective remeady against the disease.

'Gummosis' is another serious disease which affects the stem. A liquid oozes out from the affected portion and the bark cracks. The bearing capacity of the plant is reduced, ultimately the plant may die if neglected. Application of Bordeaux paste to the affected portions is recommended. (Bordeaux paste is prepared by mixing one part of copper sulphate with three parts of lime in water to a thick consistency.)

Die-back. This is a disease which is common in orchards where drainage is lacking and the soil deficient in lime. The shoot portion starts drying up from the tip downwards. In such cases the disease can be checked by promptly pruning off the affected part up to the healthy portion of the stem or branch and applying Bordeaux paste to the cut surface.

Encouragement of fruit canning and bye-product industry. As an adjunct to fruit cultivation it would be profitable to start canning of fruits and manufacture of by-products. During periods of heavy production which create a glut in the market it would be better to utilise the surplus produce for preparing preserved products of fruits instead of resorting to underselling the produce. Manufacture of lime beverages, squashes and cordials which find an easy sale during summer months should be encouraged. Preparations of citric-acid, essential oils, and fruit candies as bye products will be another enterprise in this direction. The canning of fruits like mango, jak, orange, pine-apple and the preparation of products like banana, figs, flour and crisps are not warranted under present conditions but can be taken up as and when the fruit industry of the tract develops.

Marketing. Facilities for quick and easy marketing occupy the key position of the fruit industry. The marketing system should be efficient

aiming at quick disposal of the produce at favourable rates. It is due to lack of organisation in this centre that the fruit grower is not able te get a square deal for his produce.

A system of grading of the fruits must be adopted so that the market value of the fruits may be enhanced. A well organised Sale Society on a co-operative basis must be started which will not only reduce the cost of export but also ensure fair prices for the grower all the year round. Such a procedure will effectively replace middlemen, who hold a grip over the marketing organisation at present.

Another important recommendation is the extension of the fruit growing area on account of the commercial possibility. The area to the north of Kadayam up to Tenkasi and up to Tirunelveli in the south has plenty of natural resources for fruit gardening. These regions can be exploited with profit. Large scale production will not only improve the opulence of the fruit grower but also lead to the cheapness of the commodity and ultimately to greater consumption by even the poorest class of people.

A further step in the campaign would be to encourage f uit growing by ryots with small holdings, so that every cottage can boast of a fruit orchard of its own to satisfy its requirements. The success of such schemes will have far-reaching results in the long run.

Acknowledgment. I am indebted to Sri K. C Naick, M. Sc. (Bristol) for his valuable guidance in the conduct of the survey.

A Note on Chrysanthemum Cultivation in Vellaikinar, Coimbatore.

By A. SANKARAM, B. Sc.

Introduction. The cultivation of flowers on marketable scale has of late become a profitable enterprise among the ryots of villages situated in the neighbourhood of towns and cities. Of the different flowers that have a demand in the market in South India, Chrysanthemum is the most common. The village of Vellaikinar is situated five miles from Coimbatore town. Many ryots of this village cultivate this crop in their garden lands. The crop comes in rotation either after Cambodia Cotton or Cholam.

Soil and preparatory cultivation. A successful crop is seen in localities where the soil is a fairly deep medium loam, with good irrigation and drainage facilities. After the harvest of the previous crop, the field is given 6 to 8 ploughings with a country plough and thus brought to fine tilth in the month of March-April. The field is next thrown into beds and channels with a mamutti.

Season. The preparatory work comes to a close at the end of April and planting will be in progress in May soon after some showers are received. The planting material consists of the root-stocks taken from a previous crop which has been exhaustively harvested. About 2 to 3 cents of the main field, if reserved for the rootstocks, will be sufficient to transplant an acre.

Manuring The crop responds to heavy manuring. Generally about 30 cart loads of farm yard manure per acre are carted and ploughed in before planting.

Irrigation. Just before planting the whole field has to be watered. On the fifth day after planting, a like irrigation will be given. As the crop requires copious watering, regular irrigation every week is essential. On the whole about 34 irrigations are given during the period of ten months (May—March) in which this crop is in the field. Two weeks after planting a hoeing is given. Afterwards the plots must be well hoed and weeded at regular intervals.

Picking. During the ten months' duration of the crop it gives two flushes. The first flush is from October to December after which the main flowering stems (vegetative portions only) are pruned off. The side suckers will then begin to develop and within about 1 to 1½ months the second flush commences. Picking is generally done once in six days either early in the morning or late in the afternoon. A small knife with a curved blade facilitates easy and quick harvest of the flowers. Women coolies are usually engaged for the harvest.

Yield. For each flush, about 10 pickings will be taken A single picking yields about 25 baskets of flowers containing 4 to 5 thousand flowers per basket.

The cost of each basket varies from 4 annas to 2 rupees, according to the season and the demand for flowers in the market. It is a general practice with the ryots to grow chillies, bendai and onions on the edges of the irrigation channels of this crop. These give an additional income of Rs. 5 to 10 per acre.

Economics of Cultivation. The cost of cultivation comes to Rs. 160 including picking charges. Calculating the income at Re. 0—8—0 per basket of flowers, the gross income from an acre will be Rs. 250. The net gain will thus be Rs. 90 per acre. There is a contract system of disposing of the crop in which case the contractor has to pay Rs. 100 per each flush—the picking and watching charges being borne by the contractor himself. The net gain for the ryot in this case will be about Rs. 80 per acre.

Conclusion. It will be a paying proposition indeed, to take up the cultivation of flowers by ryots of villages situated within five miles from towns and cities as there is a good demand for the flowers.

Cost of cultivation per acre—details.

Preparatory cultivation	Rs.	12	0	0
Manures—30 cart-loads of F. Y. M., carting, spreading etc.	,,	32	0	0
Planting	,,	1	8	0
34 irrigations @ Rs 2 per irrigation	,,	68	0	0
Weeding and hoeing	,,	9	0	0
20 pickings for the two flushes @ 10 women per picking	,,	37	8	0
Total.	,,	160	0	0
Yield—500 baskets valued at 0—8—0 per basket ...	,,	250	0	0
Net gain ...	,,	90	0	0

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Tea Cultivation in South India.

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Manager, Gajam Mudi Estate, Anamalais.

(Continued from Vol. XXVIII Page 169)

Nitrogenous Cover crops. Various plants of the leguminosae family are grown in tea for green manure, and for helping to stop soil erosion. The method of planting adopted is to sow the seed thinly over about 1½ feet width every other row of tea as soon after pruning as possible. (It is partly for this reason that the branches from pruning tea are usually stacked in every other row, so leaving alternate rows for planting cover crops.) Earth is lightly scratched over the seed with a *kokra*. The best times for planting are in the showery weather preceding and following the heavy monsoon. Species of Crotalaria, *Tehprosia Vogelli, T. Candida* and species of Indigofera are planted. Some Indigoferas like *I. endecaphylla* are planted from cuttings and spread over the surface of the ground giving a good protection from erosion in wet weather, but unfortunately they tend to die back entirely in dry weather, so being of no use to stop "dry wash". Some planters claim that on steep cultivated hillsides as much soil is lost in the dry weather by being pushed down by the labourer's feet and slipping of its own accord, as is lost in wet weather by wash. The other varieties mentioned are planted by seed, and being planted after the tea has been pruned, have plenty of room for quick growth. Cover crops of this kind are regularly cut back to about 1′ to 1½′ from ground level, so producing plenty of loppings for mulching over and covering the ground, and eventually rotting and supplying the ground with more nitrogenous food than has been taken out. (The various processes from fixation of atmospheric nitrogen through to its final oxidisation into nitrates for the use of the leguminous plants by Nitrosomonas, Nitrobacter and kindred bacteria, will be well-known to my readers). Once the plants are allowed to seed, they become woody and little or no more loppings will be obtainable from them, so they should be lopped when they start flowering, or when they bush out and start interfering with the tea. After about two years from planting the seed the leguminous plants become woody and useless and are rooted out. Anyway, by this time, the tea bushes have grown to a complete cover of the ground.

The dadap tree *(Erythrina lithosoperma)* being a legume is also grown for mulch especially on hill tops. It is very hard to get dadaps to grow satisfactorily in old tea especially on the poor soiled hill tops where they are most wanted, and the only satisfactory way is to rear basket plants from seed (in the same way as tea – see 1st. article) and when planting out surround the plants with farm yard manure or compost. Dadaps will grow satisfactorily from cuttings in young clearings, and in sheltered hollows and lower slopes. Rows of dadaps are grown between the grevillia rows,

but as the dadap tree gives a dense shade it should be lopped twice a year. Many planters allow the dadap tree to grow up as a single stem to about 8 feet and branch from there. My own view is that the young tree should be pollarded at 4 feet first, taking the next cut at 7 feet and standardising further cuts at 10 feet, lopping off completely all hanging branches and all growth in towards the centre of the tree. In this way dense shade under the centre of the tree is got rid of and an easily climbable sturdy tree able to withstand the monsoon gales is produced, which will produce great quantities of mulch. The dadap unlike tea, thrives on lime, and the condition of sickly trees can be improved by its application.

Manuring. In these days of restricted crop not much artificial manure is being used except on the oldest estates. Estates which from their first opening have been carefully looked after and cultivated and soil erosion on them stopped as far as possible, can keep up a steady crop for many years without deterioration. I have not much experience therefore of artificial manures, except that I know that for increasing crop i. e. leaf, nitrogen is necessary, and therefore nitrates are applied. For improving the strength of the bushes and the growth of wood, phosphates are used. But for improving the soil and bushes generally well composted cattle manure, factory rubbish, and jungle loppings are excellent, and very cheaply made if the work is properly organized, and if transport is easy. The first necessity is centralised cattle sheds, the nearer the factory the better. Periodically the factory rubbish can be taken and well mixed with cattle manure and loppings from the jungle (if the jungle is not so far away as to make cost of transport prohibitive) and heaped. The heaps need turning over and re-mixing about once a month, and watering in the dry weather and in 4 or 5 months a well rotted manure with quite a high nitrogen content will be obtained. To be worth making, it must be done cheaply, and this rough process is cheap. Complicated weighings and measurings, and temperature takings increase cost and will not produce a much superior manure. In this way, quite a small estate with 50 to 100 head of cattle on it will be able to produce 300 tons of compost manure annually, which put out and forked in at 10 tons per acre will do a lot to improve 30 acres a year of bad hill top. This compost is especially useful for getting nitrogenous crops to grow in bad soil.

(To be continued).

SELECTED ARTICLE

Production of Fertilizers in India.

By N. N. Sen Gupta, M. Sc., A. I. C. Superintendent, Government Test House, Alipur.

The principle underlying the use of fertilizers, namely, the necessity of adding plant food to the soil, was understood in a general way even in the early days of civilization. It was only about a century ago, however, that the science of plant nutrition and the requirements of the soil for certain elements, in which it is liable to be deficient, began to be clear as a result of the researches of de Saussure and Liebig on the Continent and Lawes and Gilbert in England. The versatile Lawes was not only one of the most brilliant pathfinders in agricultural science but was also the first manufacturer of a chemical fertilizer, namely superphosphate. Phenomenal progress has since been made in the manufacture of chemical fertilizers in Europe, America and Japan, and today the combined world production in the case of some of the important fertilizers is computed in terms of millions of tons. The fertilizer industry by its effect on the cost of production of sulphuric acid has given a tremendous impetus to the development of the heavy chemical industries. Since the World War of 1914—18 the synthetic manufacture of fertilizers has been greatly developed.

The intelligent use of fertilizers has become an integral part of the agriculture of the advanced countries in Europe, in America and in other parts of the world. This cannot be claimed of India; indeed, until comparatively recently the use of fertilizers by the ryot was insignificant in spite of the field experiments carried out at the different agricultural research stations in this country. The poverty of the ryot was the main impediment. In recent years, however, as a result of a combination of circumstances, including the lowered prices of fertilizers and the systematic propaganda conducted by commercial firms, the use of fertilizers by the cultivator has become considerably in excess of that on tea and coffee estates which were at one time practically the sole consumers of these commodities in India. Even now the consumption by the cultivator represents a small fraction of that which will be possible if the circumstances alter sufficiently so as to make the use of fertilizers general.

Imports and exports. In this article it is proposed to deal briefly with the production of fertilizers in India, but before proceeding to discuss production it will be well to understand the extent to which fertilizers are at present being imported into and exported out of this country. The exports consist almost exclusively of organic fertilizers manufactured from bones and animal and fish refuse which are slow acting and also unpopular in India due to religious prejudice. The imports and exports for 1938—39 are shown below.

Imports

	Tons	Value in rupees
Nitrate of soda	2,137	2,23,891
Sulphate of ammonia	76.748	82,99,126
Muriate of potash	1,829	1,82 606
Superphosphate	6,788	5,65,290
Ammonium phosphate	2,569	3,95,166
Fish manure	2,349	72,538
Other fertilizers	7,032	7,78,757
Total	99,452	105,17,324

Exports

	Tons	Value in rupees
Bones for manurial purposes	15,424	11,84,473
Bone meal	25,072	14.85.764
Fish manure	4.710	3,79.374
Guano	178	19,045
Horn meal	1,007	1,04,833
Sulphate of ammonia	1,313	1,36,455
Other fertilizers	5.546	4.11,341
Totol	53,250	37,21,685

To roughly 100,000 tons of fertilizers which are at present annually imported it is necessary to add approximately 20,000 tons of sulphate of ammonia and 2,000 tons of superphosphate produced in the country and also the amounts of the various indigenous organic manures consumed, before the total approximate, consumption of fertilizers in India can be arrived at. When it is considered, however, that the world's present annual production of sulphate of ammonia and superphosphate alone is of the order of 4,000,000 and 15,000,000 tons respectively, the comparative smallness of India's total consumption would be obvious.

Nitrate of potash. The manufacture of nitrate of potash is a very old industry of Northern India. Although potentially a fertilizer of unusual value owing to the presence of both nitrogen and potash in it, the material is not used to a large extent as a fertilizer. This is due partly to its high cost of production as compared with that of other nitrogenous fertilizers, and partly to the fact that it is in demand as a constituent of explosives. As is generally known, it is found in a crude form as an efflorescence in the surface soil where it is formed as a result of the decomposition of nitrogenous organic matter and the bacterial nitrification of the resultant ammonia. In order that nitrate of potash may be formed, potash salts must also be simultaneously available in the soil.

Saltpetre. The crude saltpetre from which nitrate of potash is obtained varies in composition and usually contains a large proportion of sodium chloride. The refining consists in removing impurities including sodium chloride. Crude saltpetre and also the earths from which saltpetre is extracted are used locally as a fertilizer, but the bulk of the meterial is refined into nitrate of potash for purposes of export. The use of the refined material also as a fertilizer is not unknown.

The production of saltpetre is at present on a much smaller scale than it was at the beginning of the nineteenth century when the export amounted to 80,000 tons per annum. The average annual export during recent years has not exceeded 8,000 tons, but presumably the present European war will again stimulate its production and export. A large number of refineries exist in the Punjab, the United Provinces and Bihar for the production of saltpetre.

From the figures given above it will be seen that some 2,000 tons of nitrate of soda is still being imported annually into this country. In the past it has been imported in much larger quantities, but apparently it has in recent years not been able to compete successfully with sulphate of ammonia. The world's entire requirement of nitrate of soda is met from Chile where it is found as a natural deposit, and there is no possibility of its manufacture being undertaken in this country.

Sulphate of ammonia. The most important fertilizer from the point of view of Indian manufacture is undoubtedly sulphate of ammonia. Some 90,000 tons

of this fertilizer are now being consumed annually in the country, and it may confidently be expected that its consumption will continue to increase. Ten years ago the total consumption in India was between 20,000 and 25,000 tons, and the increase by 300 per cent within a decade indicates the rate at which its use is spreading among the cultivators Of recent years, and of course, before the present war started, its price had been considerably lowered and the firms concerned in its sale maintained an organization for propaganda and ready availability of the material. It is not too much to expect that its price will, after the present war is over, be lowered further in order that the use of this fertilizer may be more widespread.

Until the advent of the Haber-Bosch process of synthetic manufacture of ammonia about two decades ago, sulphate of ammonia was produced entirely as a by-product in the manufacture ot coal-gas and metallurgical coke. At present the synthetic production probably exceeds the total quantity made as a by-product. The nitrogen present in the coal is given off as ammonia as a result of destructive distillation resorted to in the production of both gas and coke. The gas containing ammonia is first stripped of its tar content and is then conducted through a plant, known as the saturator, which contains sulphuric acid. Sulphate of ammonia is produced as a result of interaction between ammonia gas and sulphuric acid, and this collects as a paste at the bottom of the saturator. The paste is removed, dried and neutralized with sodium carbonate. In India the production of sulphate of ammonia dates back to 1909, and the fertilizer has so far been made practically entirely by coke plants operating in the coal-fields and also by those attached to the iron and steel factories of Bengal and Bihar. It is probably not yet generally known that the Mysore Chemicals and Fertilizers Ltd. are about to place on the market sulphate of ammonia made synthetically at their factory situated in Mysore. This marks an important new development in the production of fertilizers in this country.

The East Indian Railway's coke plant attached to the Railway's collieries in the Giridih coalfield was the first to produce sulphate of ammonia in India. The coke plant was erected in 1909. and for the first six years the acid required for the recovery of ammonia was purchased from Calcutta. In 1915 an acid plant was added which has since supplied the requirements of the sulphate of ammonia plant. The Bengal Iron Company were the next in the field and erected their by-products recovery plant at Kulti in 1915. The Tata Iron and Steel Company at Jamshedpur followed in 1916, and subsequently several other concerns, such as the Loyabad Coking and By-products Recovery Plant in the Jharia coalfield, the Indian Iron and Steel Company near Asansol and the Bararee Coke Co. near Dhanbad, began to produce sulphate of ammonia. It is understood that the newly-founded Steel Corporation of Bengal do not contemplate manufacturing sulphate of ammonia. With the exception of the East Indian Railway Coke Plant and the Bararee Coke Co., all the Indian producers of sulphate of ammonia as a by-product are members of the British Sulphate of Ammonia Federation, and the price of the commodity as sold in India is, therefore, controlled by the Federation. The largest Indian producer is the Tata Iron and Steel Company, and the total production has so far not exceeded 20,000 tons per annum.

Reference has already been made to the Mysore Chemicals and Fertilizers Ltd. This firm proposes to manufacture about 7,000 tons of sulphate of ammonia annually, and the production has probably already been commenced. It is anticipated that practically the entire output of this factory will be consumed in the Mysore State by the sugarcane cultivation and the coffee and tea estates. The factory manufactures sulphuric acid by the contact process and are the first to produce ammonia synthetically in this country. The synthetic process

adopted is known as the 'Chemico' process which is presumably an adaptation of the original Haber-Bosch process worked out in Germany and later adopted by the Imperial Chemical Industries at their works at Billingham. In principle the synthetic production of ammonia consists in combining three volumes of hydrogen with one volume of nitrogen in the presence of a catalyst; in practice, however, the process is a complicated one. Further developments in the manufacture of sulphate of ammonia will presumably be along the lines of synthetic production, but the output from coke plants should also increase as the iron and steel industry expands further.

Phosphate of ammonia. Considerable quantities of calcium cyanamide have in the past been imported into India, but owing to the increasing popularity of sulphate of ammonia its consumption has been on the decline. No cyanamide is produced in this country and none is likely to be produced, although in a note published in 1917 Dr. (later Sir) L. L. Fermor, formerly of the Geological Survey of India, suggested three possible sites for the establishment of this industry in India. A comparatively recent addition to the range of inorganic fertilizers is phosphate of ammonia which is now being imported into this country in substantial quantities. It is produced synthetically and is a double fertilizer in that it supplies both nitrogen and phosphorus to the soil. No attempt has yet been made to produce it in this country, although in view of the recent developments in Mysore there does not seem to be any reason why it cannot be made in India.

Superphosphate. The import of superphosphate has for some years been of the order of 7,000 tons per annum, and some 2,000 tons are manufactured in this country. This fertilizer is produced on a vast scale in different parts of the world, and some years ago when the Tariff Board investigated the position of the heavy chemical industries in this country, it was thought that with suitable protection from the State the manufacture of superphosphate could be developed. The difficulties attending the manufacture of this fertilizer are (1) lack of suitable rock phosphates and (2) the comparatively high cost of production of sulphuric acid in the country. Deposits of phosphates are available in the Trichinopoly district of Madras and in the Singhbhum district of Chota Nagpur, but their high iron content renders them unsuitable for the manufacture of superphosphate. Superphosphate can also be made from bones, and although the latter are plentiful in the country, they can usually be exported to fetch higher prices than are paid for imported rock phosphate. These are some of the factors which have inhibited the development of the superphosphate industry in the country. But the time may yet come when as a result of the double movement of expansion of the heavy chemical industries and increased purchasing power of the ryot a successful superphosphate industry will be established in India.

Only two firms in India have so far seriously attempted to produce superphosphate in this country from crushed bones. One of these, Messrs Dharamsi Morarji Chemical Co. of Bombay, had a comparatively ambitious scheme for production of this fertilizer, but the expectations were not realized. They continued to produce on a small scale for some years and have since abandoned this manufacture. Messrs Parry and Company of Madras are still producing superphosphate at the rate of 2,000 tons per annum, most of which is made from bones.

Basic slag obtained as a by-product of the steel industry is an important phosphatic fertilizer in England and under certain soil conditions has been known to produce remarkable results. The Indian slag is poor in phosphorus and its grinding to the requisite degree of fineness is consequently not considered to be an economic proposition.

Potassic Fertilizers. Potassic fertilizers, mainly in the form of muriate of potash, are in ordinary times imported largely from Germany and Palestine. India does not produce any potassic fertilizer except in the form of nitrate of potash which has already been discussed. Potash salts are present among the beds of rock salt in the Salt Range of the Punjab, and the question of their exploitation for manurial purposes was considered by the members of the Government Salt Department and the Geological Survey of India, but the prospects were thought to be highly doubtful.

Organic Fertilizers. India produces considerable quantities of organic fertilizers at or near Calcutta, Madras, Cawnpore and Karachi. The exact figures for production are not available, but the export figures given earlier in this articles indicate the sales of production. Unsteamed bone-meal is produced in those bone mills which crush bones for gelatine. The portion of the bones which gets powdered in the process of crushing is marked as unsteamed bone-meal. Steamed bone-meal is obtained by steaming bone pieces (usually greasy bones) in digesters under a pressure of 60/75 lb. for 2-3 hours. After drying, the steamed material is crushed to a fine powder. Steamed born and hoof meal and steamed leather meal (charmon) are produced by the same process as steamed bone-meal. Sterilized animal meal is derived from animal carcasses, etc After skinning, the dead animals are introduced into superheated rotaries and converted into dried pulp which is crushed in disintegrators. Owing to its disagreeable smell, export is difficult and the material is largely used in mixed fertilisers for tea gardens. Fish guano is obtained from the refuse of small fishes which are caught in large numbers in the Sunderbans and on the Malabar coast. This material is also difficult to export and is consumed largely in the country admixed with other fertilizers. All the organic fertilizers mentioned above are produced in substantial quantities in India. Another type of organic fertilizer which is produced in the country and used to a considerable extent by the cultivator is oil-seed cake meals. These are by-products of the oil pressing industry, and those varieties, which are not fit for use as a cattle food, find their way largely into the soil. (*Indian Farming* 1 (1940 : 211).

Ezperiments with Waste Products as Cattle Fodder in Famine Areas.

(From the Principal Information Officer, Government of India).

Investigations have lately been made by a senior worker from the Animal Nutrition Section of the Imperial Veterinary Research Institute at Izatnagar, in some of the famine stricken areas in the Punjab, Rajputana and Sind, to find out what local green roughage, if any, which when added to the agricultural and factory wastes like groundnut husk, rice husk, corn hearts, reed, bajra husks, molasses, etc., locally available, would maintain cattle even in famine conditions. Food experiments, it is understood, with these substances are being undertaken immediately at Izatnagar so that the results may be available at an early date. The chemical analyses of these agricultural and factory wastes do not, it is said campare unfavorably with wheat *bhoosa*, the roughage which is being supplied by Government organisations in these famine areas: These areas, which border the Rajputana desert, happen to have the best breeds of cattle in India. The soil is rich and in normal times crops and fodder grasses grow luxuriously, but no serious effort seems to have been made at conserving roughage for times of scarcity or tapping new sources of cheap fodder supply during famines.

For the last three years there has been no rain, with the result that there has been a complete failure of crops. Majority of the best breeds of cattle in

these areas have died of starvation or have been sent to places where some fodder is available or disposed of at ridiculously low prices. In Hissar in the Punjab for instance, there are now barely 700 milch cows as against over 16,000 in 1935. There is large incidence of deficiency diseases. Most of the animals have developed depraved appetite and all that comes before them is eaten up. There is less milk yield; conceptions are fewer, calf production is low and premature calves are being dropped. The Governments concerned have been making efforts to relieve difficulties caused by famine conditions. But a great set-back in animal production and high cost for good bullocks in future may well be apprehended.

Some of the worst affected areas, which are in Jaipur State, Rahtak and Hissar districts in the Punjab, and Tharparkar, Sind, were visited. In the plains of Jaipur, where the soil is rich, nothing grows at the moment except in small plots near the wells which are watered by lift irrigation. Most of the wells have dried up and the capacity of the others to irrigate has been considerably reduced, but,even with water scarcity, groundnut is being grown in large quantities. The groundnut oil is being used by the people and the pressed cake for animals, while husk is thrown away as a waste. No grain is given at all to milch cows or working bullocks. Only cotton seeds and cakes are occasionally available. Pipal, Acacia, Neem, Shisham, Shrub-berries and Kher are the tree fodders used for cattle. but the trees themselves are now completely denuded of leaves. It has been found, however, that the greater the scarcity of water the more profuse is the growth of shrubberries. These are being cut. allowed to dry and then the beaten-out leaves are being used as cattle fodder. Bajra is another crop which occurs in abundance. Camels and sheep and goats look slightly happier as compared with cattle. Camels, in addition to Pipal and Shisham, take Neem and Acacia leaves, but the cattle browse on them with great reluctance. That explains why mortality due to starvation is much less in camels and sheep as compared to cattle. The rocky area of the State has the advantage of retaining, after rainfall, a comparatively little more moisture. A large portion of these rocks is covered by Jhojhu and Dhak trees which give luxurious growth of leaves in spring, but Dhak is not relished by cattle, while goats and sheep take it. This, however, is not an area with a large number of cattle. It is only during the scarcity period that animals are sent here for grazing.

In Rohtak, Punjab so great has been the scarcity of fodder that it is difficult to find even a tree with leaves except those which may be toxic to cattle. There is no green crop in the field except Calatropis and other poisonous plants. Roots of grasses have been dug up by the village people for providing some sort of food to the animals. Dry leaves from shrub-berries are being used as fodder.

In Fatehabad in Hissar, which is one of the worst affected areas and where the soil is rich and grows all kinds of crops, some of the animals have now been forced into such states that they browse upon a plant locally called Bhohi, which is not usually eaten by animals, and the result is diarrhoea and in severe cases death. Night blindness is common in cattle, but not in camels and goats. Calatropis grows in abundance and so does reed. *Acacia*, *Pipal*, and *Jhal* are the tree fodders used for cattle. The Government of the Punjab are doing their best to help the people with subsidies. The Government have also opened famine centres and sell wheat *bhoosa* to the poor at reduced prices.

At Karachi investigations were made as to the possibility of using local agricultural or factory wastes as fodder. A vast area round Karachi grows cotton and a big firm in Karachi prepare decorticated cake and oil from cotton seeds.

At Naukot, in Sind, on the border of the desert, where large herds of cattle are owned in times of prosperity by an average villager, the undergrowth during rains is satisfactory, but there is nothing there now except the characteristic xerophytic plants, i. e. Cactus (thorny, hence not taken by any animal), *Jhal* (taken by camels, goats and sheep), *Bhumbar* (thorny, but taken by camels), *Dela* (browsed on by camels) and *Bhui* and Calatropis which are not eaten by any animal, except in an occasional bite by a hungry goat, but in these famine times hunger is driving the animals to these plants.

ABSTRACTS

The Pneumatic Tyre. J. A. Williamson. *Agri. Gaz. N. S.* Wales, 50: (1939) 643—646. In a series of tests at the Leeton Rice Research Station Mr. J. A. Williamson has shown that many advantages are to be obtained by fitting pneumatic tyres to farm and orchard lorries, rice headers and other cultivation implements. Reductions in drawbar pull of approximately 50 per cent. were recorded in dynamometer tests, in addition to increased speed of work, earlier working of wetland, less damage to soft land, and many other benefits of particular value to the irrigation farmer or orchardist. These advantages, however, were limited to machines and lorries hauled by horses or tractors. While the pneumatic tyred tractor proved efficient under good farming conditions, it was not as satisfactory as the steel wheeled or the crawler tractor under wet sticky soil conditions. (Author's abstract).

Changing the nature of plants (melons) by grafting. (Russian) S. P. Lebedeva, *Nov. Sel. Khoz*, Moscow, 1937, No. 16, p. 42. Grafting has made possible the spread of melon cultivation from the subtropics to Moscow. Suitable stocks are essential. The following results of grafting were established :— (a) alteration in time of ripening, (b) increased flowering induced by grafting on pumpkins, (c) female flowering in scion increased by increase in flowering of stock, (d) yield of ripe fruits on scion increased by presence of 1—2 fruits on the stock, (e) habit of fruiting changed from secondary to primary shoots and hence earlier fruiting obtained by use of a suitable stock such as *C. maxima*, (f) better rooting in pumpkin as a result of grafting with melon, (g) earlier fruiting in grafted pumpkins. The following practical conclusions were drawn :— By grafting melons on pumpkins the yield increases from 17 tons per ha. to 40 tons per ha. Melons grafted on pumpkins ripen 10—19 days earlier than otherwise. Fruits from grafted melons have a better flavour and show sugar increase of 12—14 per cent. The life of the melon plants grafted on pumpkins is appreciably longer than that of ungrafted melons both under shelter and in the open. Grafting on pumpkins on excessively wet soils can prevent 'neck-rot'. The results of grafting on the progeny are as follows better seed quality, increased percentage of successful graft, earlier maturity, higher yields, and hardier plants more resistant to diseases. (*Horticultural Abstracts* 9 (1939) : 26).

Manganese sulphate as a corrective for a chlorosis of certain ornamental plants. Dickey, R. D., and Reuther, W. *Bull. Flo agric Exp. Sta.* 319, 1938, p. 18. Experiments carried out in Florida showed that chlorotic disorders among such ornamentals as Bougainvillea, Allamanda, *Psidium cattleianum* (Cattley guava), *Thunbergia grandiflora*, *Bignonia venusta* and *Agyneja impubes* can be controlled by spraying with manganese sulphate. In the case of crape myrtle, *Lagerstroemia indica* L., soil treatments with manganese sulphate were as effective as spraying the foliage with the same material. (*Horticultural Abstracts* 9 (1939) : 49.

EXTRACTS

A New System of Field, Orchard and Garden Irrigation.

In view of the primary importance of economy in capital outlay, as well as cost of operation and transportability of equipment, we have been greatly impressed by what we have seen of the "Sigmund" irrigation equipment, which is now being marketed in this country by Messrs. Guthrie Allsebrook & Co., Crown Street, Reading, and is eventually to be produced here.

Artificial rain-making is a relatively new procedure, and although various types of equipment have been in use over sufficiently long periods to enable their merits to be tested, it has been borne upon Messrs. Guthrie Allsebrook & Co. that there is need for something different from what has hitherto been standardised, and certainly something more flexible or mobile than the fixed type of plant some farmers and intensive market gardeners have employed.

It has, of course, been ascertained that "falling rain" is more suitable to our crops than channel irrigation, and for this "falling rain" the following requirements have been specified: (1) produce fine "rain" rather than heavy drops, and distribute it evenly: (2) apply the "rain" speedily to save time; (3) moderate installation cost; (4) moderate operating cost; (5) simplicity of application; and (6) capacity to feed the crop with liquid manure or chemical fertiliser during watering.

The "Sigmund" system is declared to fulfil all these requirements. It is available in several sizes, but in each instance, from the garden type to large capacity field equipment, the principle is substantially the same, in that a jet of water of given force is delivered in an ingeniously interrupted fashion. That is to say, the delivery from the jet is distributed mechanically but intermittently in such a synchronised way that a long spray and a short one can become almost simultaneous, so that there is uniform coverage throughout the area from the position of the monitor itself to the extreme circumference of the area described by the jet as the monitor rotates.

The garden monitor rotary "rainer" as its name suggests is expressly for gardens, gold-courses and other such conditions where there is a modest area to cover and the available rate of water flow is limited as by, for example, the size of the feed pipes, a tap, etc. It can be operated from a mains water supply or from a small pump, and it will deal with a whole tennis court efficiently at one setting. Fine rain and even distribution are secured, while the choice of three jet sizes enables particular needs to be fulfilled precisely.

In respect of larger areas, the jet is projected from a fire nozzle and a faithful imitation of rain is the outcome. Unlike the garden "rainer", which is fed from a hose, this largest field monitor is fed from movable-pipe lines. The pipes themselves, we have had an opportunity of seeing, are extremely light, and three 18 feet sections can be moved by ordinary labourers as required from time to time, even when they are of main pipe line dimensions. At various intervals along these pipe-lines, there are nipples on to which hydrants are fitted in an easy coupling manner, and from these hydrants lateral pipe lines can be run almost as required, and a monitor fixed at the end of each of them. Thus from a semipermanent centre main, which can remain in place until the pump is moved, a most extensive layout can be obtained with minimum of labour, as the laterals can be moved to and reconnected to suit whatever plot may be in need of watering, and as a matter of fact, two lines or monitors can be working at a time while a third is being fixed up.

The mains are, in fact, lightweight, easily transportable steel tubes laid above ground, and they, may, for example, be set out for an early potato crop, and removed when this is dug for, say, strawberries, etc., or they can, if required, be moved about much as one would handle hose-pipes, although of course, with a little more, but not excessive effort. Patent "Express" couplings facilitate fixing together, but unlike other types of rapid couplings, which usually have loose parts likely to be mislaid, these "Express" couplings have two parts only and a specially formed rubber ring.

There are two main types of field monitor. One throws a jet which strikes a "spoon" in contrast to the rotary wheel on which a jet impinges in the garden type. The effect of the water striking this spoon causes it to be diverted from its normal path, for the "spoon", as it is hit, throws up a shower of spray which falls near the "rainer" and also as the "spoon" is hit, so is it given a turning impulse. Upon the 'spoon' being released from the force of the jet the movement imparted to the spoon arm tips a catch and allows the apparatus to turn on its ratchet base. At the same time, the motion of the "spoon" arm moves a pointed finger or needle, which splays the jet, and this second interruption means that the "rain" is not only delivered at maximum and minimum distances, but also evenly at medium range.

In another field type, the medium range is served by a finger splaying the jet, and this is operated by a spinning wheel turned by a small jet, which also rotates the apparatus and the spinning wheel itself waters the near distance There are also special types of these field monitors, which will pass even dirty-water or liquid manure that would otherwise block a small jet, and on these models the wheel is operated by the main jet.

Another alternative type is the oscillator, which some market gardeners with beds of lettuce, cabbages and similar crops find more convenient than the revolving ones, because the area to be covered is rectangular rather than circular. For joining these pipes together, a form of "Express" coupling is used, while small nozzles are fitted at intervals along the tubes, and thus there are projected jets which fall like rain. As oscillation takes place, the rain falls first at a distance then nearer and nearer to the tubes, then over them, and so to the other side to the extreme limit and back again. By this cycle, uniform distribution is obtained even on lines 100 yards long or more. The tubes are mounted on simple supports of any height convenient to the crop.

The equipment, of course, includes full pumping facilities such as the "Sigmund" two-stage centrifugal pump which can deliver 50 to 80 gallons per minute with a 100 to 175 ft. lift and a portable multistage centrifugal pump with auxiliary hand primer. This latter pump is mounted on a four-wheeled undercarriage specially designed for irrigation purposes, with a delivery of 140 to 200 gallons per minute with a 130 to 180 ft. lift. Various forms of power can be used to operate these pumps, and in some cases, a light farm tractor finds the belt driving requirements well within its power when a plant of maximum size, such as one watering 1½ acres at a time, is being operated and the water drawn from a river or stream.

All the monitors, it should be added, are of non-ferrous construction, while the RR2 and the larger sizes have machine cut double reduction worm gear that is exceedingly well made. The worm first reduction is turned by the water jet driven wheel, and a bronzle crown wheel carries an eccentric disc to operate the jet splaying arm and the second worm wheel on the same spindle. The final bronze crown wheel is fixed to the frame, so that the monitor (including gearbox and everything else) rotates around it. The whole mechanism is well packed with grease, and in each case a special self-sealing rubber gland is fitted to the

monitor to retain the water under pressure. Steel lightweight tripod legs are provided and so permit the monitor to stand level, even on sloping ground. Later on, we hope to be able to give instructive figures obtained from independent tests recently carried out. (*The Implement Machinery Review* (65 : 770—772).

The importance of vegetative cover in Soil Erosion Control.

In an experiment conducted at the Agricultural Experiment Station of the University of Missouri, U. S. A., seven plots, each 1/80th of an acre in area and elongated in form, were laid out on a loamy slope of 3.68 ft. per 100 The plots were treated as follows:—

1. Uncultivated. Weeds pulled.
2. Cultivated 4 inches in spring, and after rains.
3. Cultivated 3 inches in spring, and after rains.
4. Dense pasture of blue grass.
5. Wheat annually.
6. Rotation—maize, wheat, clover.
7. Maize annually.

The average annual rainfall for the six years of the experiment was 35·87 inches. It was found that the average run-off of water varied from 48.92 per cent of the rainfall on the uncultivated plot to 11.55 per cent of the rainfall on the pasture plot. Pasture absorbed more water than cultivated land and lost ·68 per cent as much soil as bare soil cultivated 4 inches deep.

On this evidence it may be estimated that if farm land should erode as rapidly as the soil in these experiments, the time taken to erode 7 inches of soil would be:—

Uncultivated—29 years.
Ploughed 4 inches--24 years.
Ploughed 8 inches—28 years, or about 42 tons/ac. per annum.
Maize annually—56 years, or about 15 tons/ac. per annum.
Wheat annually—150 years, or about 9 tons/ac. per annum.
Rotation—maize, wheat, and clover—437 years, or about 3 tons/ac per annum.
Dense pasture—3,547 years, or about ¼ ton/ac. per annum.

From these experiments it is evident that farmers can do much towards reducing run-off and the disastrous effects of erosion by rotating crops in such a way that the land will be covered with a growing crop for a large proportion of the time. The type of vegetation will vary according to the slope and nature of the soil.

(*Journal of Agriculture, Victoria*, 38 : 174--175).

Gleanings.

Molasses for potash deficient soils. While recent reports received from representatives of the fertilizer trade regarding future supplies are more reassuring it is nevertheless desirable that efforts be made to utilize existing Australian resources to the best advantage.

In relationship to potash, all of which is at present imported, this would call for better supervision in the rationing and distribution of molasses which is extensively employed in several areas as a means of building up depleted soils. For obvious reasons this by-product is most effective when applied to soils, which are potash-deficient. and as far as practicable molasses utilization might be confined to areas of such lands.

In the Cane Growers' Handbook it is stated that difficulty would be experienced in spreading molasses evenly in amounts of less than 5 tons per acre. This would provide, of course, much more potash than the heaviest cane crops would need. In conversation recently, a northern cane grower pointed out that molasses applications of 2 or 3 tons per acre may be made satisfactory, with a little care and assistance on the part of the farmer. We would definitely recommend, then, that the by-product be applied in dressings of these dimensions, where molasses is regarded largely as a source of potash to the ensuing crop. On average composition, 2 tons will provide the equivalent of 2½ cwt. of muriate of potash per acre, or as much potash as is contained in 5 cwt. of sugar Bureau, No. 3 planting mixture—the richest mixture available for such soils. In addition, it will provide organic nitrogen equivalent to about 2 cwt. of sulphate of ammonia.

It is certainly more economical to apply 2 tons per acre to each of two successive ratoon crops of cane, than to apply 5 tons per acre to first ratoons only. This is particularly true in regions of high summer rainfall, where losses of potash due to leaching are of a high order.

We would also stress—although it should be obvious--that after applying molasses the farmer does not require any potash in the artificial manure subsequently employed. It might be advantageous to apply superphosphate or meatworks manure in moderate amounts and a top dressing of sulphate of ammonia will be of value, especially on older ratoons.

(*Queensland Agricultural Journal* Vol. 53 1940).

Citrus Diseases Dry root rot— In orchard experiments continued at Nelspruit during the past year in connexion with the above disease results obtained indicate that (1) in the case of trees planted in well drained, aerated soil over-irrigation will not increase the incidence of dry rot provided the fertilility of the soil is maintained (2) over-irrigation may cause chlorosis, severe defoliation and dieback if the fertility of the soil is not maintained (3) fertilized trees whether normally or over irrigated are of better quality than similarly treated trees without fertilizer and (4) over irrigated trees show retrogression in yield and general health in the absence of fertilizer. (*Farming in South Africa* 24:139).

Correspondence.

To

The Editor,

Madras Agricultural Journal.

Sir,

A Correction.

We are thankful to Dr. J. A. Muliyil for pointing out a slip which has occurred in our article entitled "*Perina nuda* Fabr, a pest of fig and its natural enemies". (*Madras Agricultural Journal* Vol. 27. Page 206, last line). The word *Braconid* should have appeared for *Ichneumonid*.

M. C. Cherian,
P. Israel.

Crop and Trade Reports.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 14th June 1940 amounted to 303,560 bales of 400 lb. lint as against an estimate of 3,66,800 bales of the total crop of 1939-40. The receipts in the corresponding period of the previous year were 291,312 bales. 267,974 bales mainly of pressed cotton were received at spinning mills and 57,188 bales were exported by sea while 67,776 bales were imported by sea mainly from Karachi.

(*From the Director of Agriculture*).

College and Estate News.

Season. An active south-westerly wind characteristic of the monsoon has set in during the latter half of the month, accompanied by drizzles.

Students' Corner. The college reopened on the 15th instant and students of the 2nd and 3rd year classes have assembled after the vacation.

The selection of the new batch of students for the B. Sc. Ag. degree course has been completed. 47 students in all have been selected of which 22 are from Telugu districts, 19 from Tamil districts, 3 from Malabar and 3 from South Kanara.

We regret that the results of the B. Sc. Ag. degree examination could not be published in the last issue of this journal due to unavoidable circumstances. They are now published elsewhere in this number.

Visitors. Mr. P. H. Rama Reddi, Director of Agriculture, Madras arrived here from the Nilgiris on the 3rd June and returned to Ootacamund on the 4th morning.

Mr. A. R. C. Westlake, I. C. S. the director-designate visited the Central Farm and Research Sections on the 7th instant, prior to his taking over charge as Director of Agriculture on the 10th instant.

The members of the Agricultural College selection committee consisting of the Director of Agriculture, Madras, the Principal, Agricultural College, Coimbatore; Sri K. P. Mallikarjunudu, M. L. C., Advocate, Masulipatam; Janab P. I. Kunhamad Kutty Hajee, M. L. A,, Vice Chairman, Calicut Municipality and Sri T. Sivashanmugam Pillai, M. L. A., interviewed the candidates for admission into the Agricultural College on the 22nd instant.

The members of the Kamal Yar Jung Education Committee of which the Hon. Mr. M. Azzul Huque, C. I. E., Vice Chancellor of the Calcutta University is the chairman, visited the College and Research Institute on the 8th instant.

Officers' Club. In the Presidency Contract Bridge tournament conducted under the auspices of the Cosmopolitan Club, Coimbatore, the following members of the Officers' Club came out successful.

It is to the credit of the Officers Club that for two successive years its members have won this tournament.

Winners. C. S. Krishnaswami and M. A. Sankara Ayyar.

Runners ap. G. K. Chidambaram and P. S. Narayanaswami.

Personal. Mr. C. S. Krishnaswami, B. A., B. Sc., Ag., Assistant to the Government Mycologist, has been deputed to go to Poona to study virus diseases for three months under Dr. Uppal, Plant Pathologist to the Government of Bombay.

We are glad to learn that Mr. N. Keshava Ayyangar, M. A.. M. Sc. (London) has been selected for appointment as Cytological assistant for Cotton research work in Surat under the auspices of the Indian Central Cotton Committee.

Simla meeting of the I. C. A. R. Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist and Geneticist and Mr. P. V. Ramiah, Government Agricultural Chemist were deputed to Simla to attend the fodder sub-committee and the Soils sub-committee of the Imperial Council of Agricultural Research.

Mofussil News and Notes.

Kuruvikarambai-vaikasi visagam festival. Kuruvikarambai is a big village, situated 4 miles to the east of Peravurani. In the village there is a Subramania Swami's Mutt belonging to Sri. A. V. Balasubramania Servikarar of Karambaikadu, a big landholder in the sub-circle, On the 6th, 9th and 10th of the Vaikasi Visahgam festival worshippers congregate in large numbers from the surrounding villages. An agricultural exhibition was held from the 19th to 21st May on the said important days. Exhibits included the chief varieties of Paddy and sugarcane, fodder crops, green manure crops, pine apple fruits, fruit plants from Panyam. Charts on agricultural subjects were posted prominently. Many people visited the stall and showed keen interest in the exhibits. A. G. N.

Namakkal (Salem District). A rural Industrial Exhibition was opened on 29—5—40 at 5 p. m. by the District Collector at the Board High School, Namakkal. The Agricultural, the Health, Co-operative, Education and Veterinary departments had opened stalls in the building. Besides Government departments, private people had exhibited their wares such as cabinets, Indian medicines, pottery products, footwear, mats and carpets. In the Agricultural stall, several improved varieties of paddy, cotton seeds, groundnuts, a few millets, lika cholam and tenai, two good clumps of Co. 419 sugarcane, charts and illustrations of entomological and mycological interest, green manure seeds, agricultural implements such as Buckscraper, chaffcutter, B. B. Mhotewheel, H. M. Guntaka Nos. 1 and 2, McCormick Deering cultivators, country drill set, Cooper ploughs No. 25,11 and 26, bund-former and ridgeplough were on show. Some ryots also exhibited excellent specimens of their produce the most important being fruit varieties from Kollimalais, Alanganatham and Belukurichi. Two bee-hives were also kept and their working was appreciated by visitors. During the eight days of exhibition, 3870 visitors visited the stalls and many testified to the excellence and educative value of the agricultural exhibits. On the closing day, prizes were awarded by the Assistant Collector to the producers of Co. 419 sugarcane (Mr. Kathapalli Nallappa Reddiar) and the best exhibits of Kollimalai produce. Certificates of merit were awarded to the exhibitors of fruits (two in number) and two bee hive owners. P. K. N.

Pendyala (Kistna district). The training classes in modern bee-keeping inaugurated at Kanchala, Nandigama Taluk, on 9—5—'40 by Rao Bahadur C. J. Paul, B.A., Collector of Kistna district, finished its sessions on 3—6—'40 after a period of three weeks. During the period, the students who were 13 in number, were given a thorough training in the theory and practice of Apiculture. Facilities for hiving wild colonies of bees from nature were also amply provided for. Successful students were awarded certificates of merit. The Secretary of the Training School in a short speech advised the students to do their best to popularise this industry among the rural folk in their respective areas. He further exhorted them not to get discouraged by initial failures but to redouble their efforts to attain success whenever they may fail. He emphasized the importance of Cottage Industries in the present day conditions of India and wanted every one of them to contribute their quota in the furtherance of this subsidiary industry by being themselves honest and helpful to the villagers. They were requested to become members of the All India Bee-keepers' Association which exists to serve the need of every novice and expert in the field, thereby subscribing to the *Indian Bee Journal*, the only one of its kind in India which would keep them in touch with many up-to-date topics on the subject of bee-keeping. With a vote of thanks to the chair by the students, the gathering dispersed. S. A. P.

Shiyali. An Agricultural Exhibition was held during Thrimmulaipal Festival from 12th April to 22nd April. Besides the usual display of paddy and rice samples of the different strains, improved ploughs and other implements recommended to the rice grower, live specimens of a large range of green manure and fodder plants, and *Korai* mat grasses raised in plots and the attractive display of locally grown fruits like sapotas, figs, pomeloes, Sathgudi oranges and mangoes formed a special feature of the exhibition. The other exhibits included different breeds of poultry, bee hives, smokers and honey extractors. Fairly large crowds were attracted to the exhibition daily and the importance of the different exhibits explained to the interested visitors. M. A.

Tiruvadi. (*Tanjore District.*) A large scale Agricultural Exhibition was held in the Central High School, premises, Tiruvadi between 23rd and 26th April 1940, during the Sapthasthanam festival. Tiruvadi is considered to be the South Benares and for this festival over a lakh of people assembled. The Tanjore District Board, Co-operative Milk Supply Union, Tanjore, South Indian Nursery, Kumbakonam were among others who co-operated. The perfect electric illumination of entrances and stalls coupled with the radio equipment provided by the District Board increased the attractiveness of the exhibition and over 10,000 persons visited the stall. Agricultural implements were worked in a separate area as demonstration to ryots who gathered. This year's exhibition was the best ever arranged here. A. G. N.

The International Yearbook of Agricultural Statistics.

We have been requested to give publicity to the following by the International Institute of Agriculture, Rome:— Ed. M. A. J.

Among the publications of the International Institute of Agriculture now in preparation is the International Yearbook of Agricultural Statistics, 1939—40, which owing to its scope and accuracy, is a basic reference book for those who study the problems of agricultural production, trade and prices. The Yearbook, which contains a thousand pages, has now reached its twentythird edition. It provides series of statistics on the area and population of all countries in the world, on the areas, yields per hectare and production of the various crops and on the numbers of livestock and poultry. Four hundred pages devoted to international trade show the course of movements between exporting and importing countries of the principal agricultural products during recent years. Another section gives the prices in various currencies of a wide range of products, Index numbers, monthly gold prices, freight rates and exchange quotations. A section of special interest in view of the progress in cultural technique, is that relating to the production, consumption and prices of fertilizers.

The 1939-40 edition contains, in addition to all the useful features of earlier issues, further improvements which make it an indispensable source of information on agriculture and on its importance in the various countries of the world.

Weather Review—MAY 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	13·7	+11·7	21·0
	Calingapatam	11·6	+9·0	15·8
	Vizagapatam	9·7	+7·7	11·5
	Anakapalli*	9·8	+7·5	14·7
	Samalkota*			
	Maruteru*	4·6	+3·2	6·4
	Cocanada	5·7	+4·2	10·0
	Masulipatam	0·9	−0·4	3·8
	Guntur*	1·2	−0·9	5·7
Ceded Dists.	Kurnool	3·2	+2·1	4·7
	Nandyal*	0·0	0·0	0·0
	Hagari*	7·3	+5·6	9·5
	Siruguppa*	3·3	+1·7	4·5
	Bellary	8·3	+6·3	9·2
	Anantapur	3·9	+1·7	4·5
	Rentachintala	5·9		6·2
	Cuddapah	9·6	+8·0	10·2
	Anantharajupet*	5·9	+4·9	7·0
Carnatic	Nellore	6·9	+6·1	10·5
	Madras	5·4	+4·3	6·1
	Palur*	2·6	+0·7	3·5
	Tindivanam*	3·7	+3·6	5·1
	Cuddalore	2·7	+2·0	4·0
Central	Vellore	3·4	+1·1	4·7
	Salem	8·1	+3·4	12·4
	Coimbatore	9·7	+7·3	13·0
	Coimbatore A. C. & R. I.*	5·0	+2·4	8·6
	Trichinopoly	4·6	+1·5	5·8

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	1·9	+0·3	2·6
	Aduthurai*	2·6	+0·6	6·1
	Madura	4·3	+1·4	8·6
	Pamban	1·8	+1·0	8·7
	Koilpatti*			
	Palamkottah	1·9	+0·3	6·6
West Coast	Trivandrum	7·3	−1·2	14·2
	Cochin	9·0	−2·7	15·0
	Calicut	8·3	−0·2	8·9
	Pattambi*	4·5	−3·6	7·8
	Taliparamba*			
	Kasargode*	3·9	−4·5	7·6
	Nileshwar*	7·8	−1·2	8·4
	Mangalore	6·0	−0·2	6·7
Mysore and Coorg	Chitaldrug	3·7	+0·6	5·8
	Bangalore	7·6	+3·2	9·3
	Mysore	6·4	+1·2	8·7
	Mercara	5·3	−0·4	10·2
Hills	Kodaikanal	9·9	+3·9	18·5
	Coonoor			
	Ootacamund*	8·8	+3·3	14·5
	Nanjanad*	6·2	+0·5	10·4

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather Review for May 1940. During the 1st half of the month, due to secondary low pressures derived from the western disturbances traversing upper India, widespread thundershowers occurred in the Konkan, Bombay Deccan, Hyderabad, Malabar and South East Madras. On the 18th a depression appeared in the Bay of Bengal off the Coromandel Circars coast and caused a temporary advance of the South West Monsoon in the South Bay of Bengal and the South East Arabian sea off the Malabar and Ceylon coast. This developed into a severe cyclonic storm on the 20th and was centred near Nellore. It caused heavy rains in North Madras coast, Mysore and Madras Deccan. It weakened after crossing the coast on the 21st and lay over South Hyderabad and passed out into the Bay from the Orissa coast on the 23rd. A second depression appeared over the north of the Bay on the 27th but weakened and became unimportant by the 30th.

Rainfall in connection with the first depression was widespread and very heavy. It was in very large excess over most of the area except the west coast where it was in slight defect. Skies were heavily clouded in the Konkan, Bombay

Deccan, South Madras and Mysore and the relative humidity was in excess in most places. Day temperatures were below normal in the Bombay Deccan, Hyderabad, Mysore and South East Madras. Night temperatures were above normal in North Madras coast and Hyderabad. Rentichintala recorded the highest maximum of 114°F on the 14th.

Special falls of rain:

Gopalpore 5·0"
Vizagapatam and Calingapatam 4·9"
Madras 4·7"
Cuddapah 4·5"
} All on the 20th.

Bellary 6·7" and Nellore 6·4" on the 21st.
Gopalpore 3·5" on the 22nd.

Weather Review for the Agricultural College & Research Institute Observatory:

Report No. 5/40.

Absolute Maximum in shade	...	92·5°F
Absolute Minimum in shade	...	68·0°F
Mean Maximum in shade ...	...	90·6°F
Departure from normal ...	...	−4·4°F
Mean Minimum in shade ...	...	73·7°F
Departure from normal ...	...	−0·3°F
Total rainfall for the month	...	5·0"
Departure from normal ...	...	+2·4"
Heaviest fall in 24 hours ...	...	1·3" on the 5th.
Number of rainy days ...	...	8
Mean daily wind velocity ...	...	2 m. p. h.
Departure from normal ...	...	−1·7 m. p. h.
Mean Humidity at 8 hours	...	74%
Departure from normal ...	...	+3·8%

Summary. Local thunder showers and an advance of the South West Monsoon caused heavy rains during the month. The rainfall was 5·02" which is nearly twice the normal amount for the month. Skies were moderately to heavily clouded and the humidity was in slight excess. The Mean Maximum temperature and the Mean Minimum temperature were both below normal. The Mean daily wind velocity was also below normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Leave.

Name of officers.	Period of leave.
Sri. B. Ramiah, Dy. D. A. (on leave).	Extension of leave on m. c. on half average pay for 3 months from 1—6—'40.
„ K. Raghava Acharya, A. D. A. (on leave).	Extension of L. a. p. for 1 month from 21—6—'40.

Subordinate Service.

Appointment.

Sri. K. R. Nagarajan, B. Sc. (Ag.) Fieldman, Agricultural Research Station, Palur is appointed to Category 1, Class I, Madras Agricultural Subordinate service and to officiate as Upper Subordinate, Agricultural section, III grade on Rs. 75 in the new revised scale of Rs. 75-7½/2-105 with effect from 17th June 1940.

Promotions.

The following promotions of upper subordinates in the Agricultural section are ordered with effect from 1st April 1940:—

From IV grade Rs. 120—10—170 to III grade Rs. 200.

1. Sri. A. Ramaswami Ayyar, permanent upper subordinate, Agricultural section IV grade to III grade.

2. Sri. V. T. Subbiah Mudaliar, permanent upper subordinate, Agricultural section IV grade to III grade.

From V grade Rs. 85—5—120 to IV grade Rs. 120—10—170.

1. Sri. N. C. Tirumalai Acharya, permanent upper subordinate, Agricultural section V grade to IV grade.

2. Sri. P. A. Venkateswara Iyer, permanent upper subordinate, Agricultural section V grade to IV grade.

3. Sri. S. S. Katchapeswara Ayyar, permanent upper subordinate, Agricultural section V grade to IV grade.

4. Sri. N. S. Rajagopala Ayyar, permanent upper subordinate, Agricultural section V grade to IV grade.

5. Sri. V. Karunakaran Nayar, permanent upper subordinate, Agricultural section V grade to IV grade.

6. Sri. K. Varada Acharya, permanent upper subordinate, Agricultural section V grade to IV grade.

7. Sri. D. Bapayya, permanent upper subordinate, Agricultural section V grade to IV grade.

8. Sri. K. Sivasankara Menon, permanent upper subordinate, Agricultural section V grade to IV grade (provisional).

9. Sri. P. K. Parameswara Menon, permanent upper subordinate, Agricultural section V grade to IV grade.

10. Sri. A. Ram Mohan Rao, permanent upper subordinate, Agricultural section V grade to IV grade.

11. Sri S. V. Ramachandra Ayyar, permanent upper subordinate, Agricultural section, V grade to IV grade,

12. Sri P. S. Venkuswami Ayyar, permanent upper subordinate, Agricultural section, V grade to IV grade.

13. Sri P. Sudarsanam Nayudu, permanent upper subordinate, Agricultural section, V grade to IV grade.

14. Sri T. Gopalan Nayar. permanent upper subordinate, Agricultural section, V grade to IV grade.

15. Sri K. B. Vydiswara Ayyar, permanent upper subordinate, Agricultural section, V grade to IV grade.

The following provisionally substantive promotion of upper subordinate in the agricultural section is ordered with effect from 15th August 1939.

From III grade (new) on Rs. 75—7½/2—105 to II grade on Rs. 105—15/2—130 (Existing revised scale).

1. Sri T. K. Thangavelu, permanent upper subordinate, Agricultural section, III grade (new) to II grade (new) (provisional).

Transfers.

Name of officers.	From	To
Sri T. Venkatarama Reddy,	Offg. Asst. in Millets, Coimbatore,	Oflg. Asst. in Botany, Coimbatore.
„ K. Venkataswami Nayudu,	Offg. F. M. A. R S., Nandyal,	Offg. Assistant in Millets, Coimbatore.

„ B. Madhava Rao,	Asst. A. D., Anakapalle,	Asst. A D., Narasanna.
„ Bhagirathy Padhy,	A. D., Narasannapeta,	A. D., Palakonda.
„ M. D. Narayana Reddy,	Asst. A. D., Palakonda,	Asst. A. D., Vizagapatam.
„ N. M. Bhukta,	Asst. A. D., Vizagapatam,	Asst. A. D., Tekkali.
„ M. Gopala Rao,	Asst. A, D., Tekkali,	Asst. A. D., Anakapalle.
„ K. Bhushanam,	Offg. F. M. A. R. S., Anakapalle,	To undergo Dt. work training (Cocanada).
„ K. Govinda Kurup,	A. D.. Paramakudi,	Dairy Manager, Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri S. P. Fernando, Asst. A. D., Harur.	L. a. p. for 1 month from 7—2—40.
„ P. K. Kannan Nambiar, F. M. A. R. S., Nileshwar II.	L. a. p. for 1 month and 13 days from 19—6—50.
„ D. Shanmugasundaram Pillai, A. D., Arupukottai.	L a. p. for 1 month from 12—6—40.
„ M. Somayya, A. D., under training, Tuni.	L. a. p. for 2 months from the date of availing.
„ D. Hanumantha Rao. A. D., Cocanada.	Extension of l. a. p. for 1 month from 12—6—40.
„ S. Ramachandra Ayyar, A. D., Tinnevelly.	Extension of l. a. p. for 1 month from 9—6—40.
„ Bhagirathy Padhy, A. D., Narasannapeta.	L. a. p. on m. c. from 1 month from 1—6—40.
„ K. M. Jacob, A. D. (on leave).	Extension of l. a. p. on m. c. for 2 months from 11—6—40.
„ G. J. Balaraj, Asst. A. D., (on leave)	Extension of l. a. p. on m. c. for 1 month from 29—5—40.
„ V. Karunakara Nayar, Dairy Manager, Coimbatore.	L. a. p. for 2 months from the date of relief.
„ M. K. Gopalan, A. D., Proddatur.	Extension of l. a. p. for 1 month.
„ A. R. Krishnamurthy Iyer, Asst. A. D., Karur.	L. a. p. for 2 months from 3—6—40,
„ G. L. Narasimha Rao, Asst. A. D., Vuyyur.	L. a. p, on m. c. for 2 months from 7—5—40.

UNIVERSITY OF MADRAS

B. Sc. Ag. Degree Examination—1940.

List of successful candidates.

First Examination.

Adivi Reddi, A.
Ananthakrishnan, N.
Ananthakrishna Rao, P. N.
Dharmakkan Isaiah.
Duraiswami, K. N.
Edward, L. J. D.
Gurubasappa, H.
Hanumanta Rao, K.
Jagannatha Rao, Y.
Krishnamoorthi Rao, S.
Krishnan, B. S.
Kutumba Rao, V. V.
Mahimaidas, V.
Mrutyunjaya Sastry, R.
Nageshwar Rao, J. P.
Picheswara Rao, M.
Radhakrishna Reddi, A.
Raja Rao, K.
Ramakanta Reddi, C.
Ramamohana Rao, K.
Ramanadham, S.
Ramaratnam, W. S.
Rami Reddi, T.
Ranga Rao, K.
Sankara Rao, C.
Sethuraman, M. S.
Sivasubramanyam, P. K.
Srinivasa Rao, B.
Subba Rao, K.
Subba Raju, A.
Subramanyam, J.
Subramanyam Reddi, C.
Subramanyam, A,
Sundararajan, C. L.
Suryanarayana, K. S.
Suryaprakasa Rao, P. V.
Syed Muhamad, D. A.
Thandavarayan, K.
Theophilus Chellappa.
Venkatarama Reddi, C.
Vijayaraghavan, K. S.
Yegneswara Chintamani, P.

Second Examination.

Bhaskara Reddi, N.
Chinnappa Reddi, D.
Daniel Sundararaj, D.
Hanumantha Rao, B.
Jagannathan, N.
Minakshisundaram, M. N.
Muhammad Ibrahim, P. A.
Narasimham, B.
Narasimhamurthi, D.
Narayanamurti, R.
Narayana Nambiar, M.
Paramananda Panda
Radhakrishna Rao, D.
Rajagopalan, V. R.
Ramalingam, C.
Ramalingam, M.
Rama Rao, G.
Ramasubramaniam, S. N.
Sambamurthi, K.
Sanyasi Rao, U.
Seshavataram, B.
Shaukat Ali, K. A.
Sheenappa, K.
Srinivasan N. V.
Srinivasan, S. T.
Srinivasan, S. V.
Srinivasalu, N.
Tiruvengatachari, T. K.
Vasudeva Rao, B.
Venkataramanamurthi, C.
Venkateswara Rao, P.
Venkateswara Rao, T.
Krishnamurthi, C. S.
Padmanabha Row, K.
Sreshta, N

Final Examination.

Azariah, M. D.
Bhaskaram, K.
Bhaskara Rao, M. V.
Fazlullah Khan, K.
Cunha, E. V. J.
George Harris Maduram.
Jagannatha Rao, E.
Kailasa Rao, T.

Kesava Reddi, A. G.
Krishnamurti, C. S.
Muhammad Sulaiman, S. M.
Muthuperumal, V.
Muthuswami, T. D.
Narayana Rao, K.
Narayana Reddi, B.
Padmanabha Rao, K.
Peeraraju, A.
Rajasekhara Shetti, K.
Ramanathan, R.
Ramaswami, K. S.
Ramiah, M.
Sambandam, R.
Sivasubrahmanyam, T.
Sreshta, N.
Srinivasan, K.
Sumitra Rao, U.
*Vengala Rao, K. C.
Venkataratnam, L.
*Venkateswara Chayanulu.
Viraraghavan, R.
Aiyappa, K. M.
Chellappa, G. V.
*Gopalakrishna Gokhale.
Venkatta Subba Rao, R.
Md. Baig.
Anantaraman, R.
Francis Samuel.
Sivaraj, A.
Sreenivasam, P. S.

The following candidates have references in the subjects noted :—

Second Examination. *Animal Hygiene* Achutaramaraju, Narayana Kamath, K. M. Somanna, U. V. Tyagaram. *Engineering.* Monappa Hedge, H., P. V. Ramamurthi, C. M. George. *Agricultural Zoology.* D. V. Ramana Rao.

Final Examination. *Chemistry.* M. Mohan Punja, G. V. Raghavulu. *Agricultural Economics and Farm Management.* K. Murti Raju, B. Padmanabharaju, M. S. Kulandaiswami.

* Have to pass Engineering Examination.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

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THE TWENTY-NINTH COLLEGE DAY AND AGRICULTURAL CONFERENCE, 1940.

The twenty-ninth College Day and Agricultural Conference organised by the Madras Agricultural Students' Union, Coimbatore was held between 13th and 17th July. Hardly two months ago owing to the need for economies during a period of war, the Union executive was entertaining doubts and fears about the feasibility of holding the annual conference which fell due in July this year. It is now a matter of satisfaction both to the members of the Union and agricultural interests of this province that thanks to the efforts of the Director of Agriculture, these fears were allayed and the holding of the annual conference has become an accomplished fact. Though bereft of some of the usual side shows associated with the conference eg. the staging of an agricultural exhibition and a departmental conference of gazetted officers, the conference which is now over will go down in the history of the union as one of its most successful sessions.

Saturday, the 13th July witnessed the College Athletic Sports. One noteworthy feature of the years' sports was the inclusion in the programme of standard Olympic events and the change over to the metric system for track events. The Union was "At Home" to the large congregation of members and guests who had assembled to witness the contests. At the conclusion of the sports Mrs. K. M. Unnithan kindly gave away the trophies and prizes to the successful competitors.

At 12 noon on Monday the 15th July, Mr. S. V. Ramamurty, M.A., I.C.S., Member, Board of Revenue, of Madras and president-elect of the conference, was received at the entrance to the conference hall by Messers A. R. C. Westlake, Director of Agriculture, Madras, Mr. R. C. Broadfoot, President of the Union and Mr. M. C. Cherian, Vice-president.

Mr. R. C. Broadfoot, president of the Union welcomed the large and distinguished gathering with a welcome speech (reported elsewhere).

At this stage a loyalty resolution couched in the following words was moved from the chair and unanimously adopted.

"This conference of the Madras Agricultural Students' Union places on record its whole-hearted loyalty to the cause for which Great Britain and India are fighting and resolves to contribute all the help that lies within the power of its members for the successful prosecution of the war".

The secretary then read several messages received from the patrons, members, friends and wellwishers of the Union who were unable to be present but accorded their best wishes to the success of the conference.

The annual report of the Union was then read by the secretary, the chairman of the conference then gave away the prizes and medals won by the students of the College during the academic year 1939—40.

The chairman then delivered his presidential address (reproduced elsewhere) which was as inspiring as it was erudite and was listened to by the gathering with rapt attention. He complimented the Department of Agriculture on the high standard of work turned out by it but laid stress on the real background against which one has to view prospects of agricultural development through the help of scientific research, and the need for setting right the maladjustments between agriculture and industry. The rest of the afternoon's proceedings was occupied by a symposium on "Soil erosion" to which six papers were contributed. A pleasing feature of the symposium was that three of the papers were extra-departmental contributions representing the Forest department, the South Indian Tea Industry and the Indian Coffee industry respectively. In the interesting discussions which followed the members of the department and the general public took part.

On the 16th morning the conference was resumed at 9 a. m. when six papers covering a wide range of agricultural subjects were presented and discussed. In winding up the proceedings the chairman made a masterly summing up of the papers and the discussions which followed. He made a strong plea to the scientists to recast their attitude to tradition because science was latent in tradition and there was much in the cultivator's traditional methods which could give the scientist greater confidence to follow new lines and enrich old practices. The chief difference he could detect between science and tradition was that the former was built up as the result of experience gained leisurely through a long space of time, while the latter aimed at quick results and the saving of time. The chairman urged that the way of finding an economic living for the educated unemployed was by adopting an agro-industrial economy and not merely agricultural economy. Villages which could ill afford to provide the modern amenities of life had to be regrouped into units so that each group can provide the necessary amenities.

Mr. A. R. C. Westlake, Director of Agriculture, in a humorous speech proposed a vote of thanks to Mr. Ramamurty for his very interesting and illuminating address. On behalf of the Madras Agricultural Students' Union Mr. M. C. Cherian proposed a vote of thanks to the several members of the Union and friends who contributed to make the conference and other functions a success.

On 16th night the members of the Union entertained Mr. and Mrs. Ramamurty and other visitors, when short pieces in English, Telugu and Tamil were staged. The histrionic talents exhibited by the actors, most of

whom were students of the College, were widely appreciated by the audience.

On the 17th morning the members of the Union met in the Freeman hall where the union was 'At home' to its members. After *chota hazri* they adjourned to the conference hall where the annual general body meeting of the Union was held under the chairmanship of Mr. R. C. Broadfoot, President of the Union. The annual report and statement of accounts were adopted and the office-bearers for the year elected.

The afternoon was spent in visits to the Research Institute, Central Farm and Crop-breeding stations where the district officers and the lay public were shown round the work in progress and the results achieved in the immediate past.

Welcome Address.

(By R. C. Broadfoot Esq., President of the M. A. S. Union.)

Mr. President, Ladies and Gentlemen,

Once again it is my privilege as President of the Madras Agricultural Students' Union to extend the Union's welcome to all of you attending this the 29th College Day and Conference and I hope you will all add your quota to make the conference as successful as its predecessors. Economic restriction limits the number of departmental officers permitted to attend, but it is for each one to make the most of the opportunities offered to revive these contacts with their *alma mater* and with friends who may be present from distant places.

To-day's symposium deals with the problems arising from soil erosion—a subject of great importance throughout the world. Its importance to Indian agriculture is also recognised and it is hoped that the papers now contributed will furnish some assistance in controlling this very serious problem.

To you, Sir, I would express on behalf of the Union our grateful thanks for accepting our invitation to preside over this Conference. As a former Secretary to Government in the Development Department and later as Director of Agriculture you became aware of the many problems confronting us and we look on your presence here today as an assurance of your continued interest in the Agricultural Department and its work. We extend a welcome to Mr. Westlake who as Acting Director of Agriculture attends this Conference for the first time. As his stay will extend beyond the period of the Conference there will be opportunities to show him the work of this Institution in greater detail before he leaves.

We miss from this conference and mourn the loss sustained by the deaths during the year of Rao Sahib T. V. Rajagopalachari, a former vice-president of of the Union and Rajah Sir Vasudeva Raja of Kollengode, one of our patrons. We offer our condolences to the bereaved families.

This conference meets under the shadow of a dark and heavy war cloud which starting in September last has grown to alarming dimensions engulfing many of the smaller neutral nations of Europe. While thinking of the fate of many smaller nations of Europe we must realise the need for steps being taken to ensure India's protection and for this reason alone it is our duty to give what assistance we can to secure victory for the Empire against the aggressive forces seeking to destroy it.

For financial reasons the Departmental Exhibition which has been a feature of the last three conferences has been dropped this year, but arrangements have

been made by all heads of sections to receive interested visitors in their own sections and show them the work in progress in each section. It is hoped that a large number of visitors will avail of this special invitation. The truly agricultural community will be dealt with at the Central Farm and adjoining plant breeding stations, where farm managers will make the necessary arrangements for visitors' inspection.

The season so far has been favourable; good, though unexpected, rains in May have relieved the strain of previous years' low rainfall and fodder crops in particular have never been better in this area.

The college continues to work successfully and the results of the last B. Sc. Ag. degree examinations are satisfactory both to the students and the teaching staff. Students who have been lucky, or should I say diligent enough, to secure prizes will receive these at the close of the presidential address and I would in one word congratulate them on their achievements. Prize winners invariably do well in after life, but runners up and less successful students may derive consolation from the knowledge that character is perhaps as great an asset in practical life and it has been the aim of this college to teach its students to be able to stand on their own legs when the need arises.

It is gratifying that the college should continue to maintain its popularity among similar institutions providing instruction of a professional character. The number of applications received this year, though slightly lower than in the preceding two years, made the work of the Selection Committee sufficiently onerous. The new students joined the college early in the month and are therefore just settling down to their work. Some of the selected students have been fortunate to secure places in other colleges and having accepted these, it is clear that Agriculture was an emergency choice and the final strength is 44 against a maximum of 48 usually chosen. Hyderabad and Orissa are again represented by State-selected students.

This welcome address closes with the usual request and that is for students leaving the college to keep in touch with the college and their former student friends through the medium of the Madras Agricultural Students' Union. It is again emphasised that outside officers do not bear their share in the work of the Union. If the best results are to be expected it is necessary for all members to contribute their quota in cash or kind. *The Madras Agricultural Journal* will look after their literary contributions, but cash provides for necessary expenditure for printing and distribution of the monthly journal. Is it therefore too much to beg from you continued and extended support in a worthy effort of which we are justly proud?

Messages.

The following are some of the messages received :--

Sir Mirza Ismail, Dewan of Mysore:

I thank the president and members of the Madras Agricultural Students' Union, Coimbatore, for their kind invitation to the 29th College Day and Conference to be celebrated from the 13th to the 17th July and send my best wishes for the success of the function and the prosperity of the students and staff of the College.

Mr. V. I. Muniswamy Pillay, till recently Minister for Development in the Government of Madras:

I regret my inability to be present on the occasion due to prior engagements but wish the several functions thorough success. I am glad to find you

have chosen Sri. S. V. Ramamurty to preside, and you are bound to hear very valuable and practical things from one who has been connected for several years in agricultural administration.

Mr. P. H. Rama Reddy, Director of Agriculture (on leave):

Regret absence, wish all functions complete success.

Rai Bahadur N. Nallathambi Sarkarai Manradiar, Pattagar of Palayakottai;

I thank you for your kind invitation for the 29th College Day and Conference; but regret very much my inability to attend. I wish the functions every success.

Dewan Bahadur D. Ananda Rao, Retired Director of Agriculture, Madras:

I very much regret my inability to be present on the occasion but I take this opportunity to wish the Conference and festivites connected with the College Day every success. Soil erosion is one of the important causes of the infertility of our soils and if anything could be done to reduce it, I am sure the ryot would be grateful if the means suggested are within his capacity to follow.

Rao Bahadur B. Viswanath, Director, Imperial Agricultural Research Institute, New Delhi:

Wish College Day and Conference success.

The Zamindar of Bodokhemidi, Berhampore:

I thank you for the kind invitation for the 29th College Day and Conference but I regret my inability to attend.

Rao Bahadur M. R. Ramaswami Sivan, Retired Principal of the Agricultural College:

As one connected with the Union and its functions from the very inception 29 years ago, I very much regret my inability to attend these functions in person. My heart is there, and my hearty good wishes are with you all for a successful session. We cannot have, at this juncture, a better person to preside at our meetings than Mr. S. V. Ramamurty, our popular ex-Director of Agriculture; and I am sure that he will give us, the necessary guidance to march on in the cause of our motherland and of the British Empire.

Rao Bahadur C. Tadulingam, Retired Principal of the Agricultural College:

Wish college Day Conference every success.

Rao Bahadur Y. Ramachandra Rao, Locust Entomologist, New Delhi:

Best wishes success College Day Conference.

Mr. K. Ramiah, M. B. E., Botanist and Geneticist, Institute of Plant Industry, Indore:

I very much regret I shall not be able to attend. I am missing a very interesting session and I must congratulate the Union in its choice of the president for the year. I wish your conference and College Day all success.

Rao Sahib Dr. T. V. Ramakrishna Ayyar, Retired Government Entomologist:

As one who was closely connected with the College and union for some years and as an amateur farmer at present, please allow me to convey to you and all the other members of the Union my hearty good wishes for the success of the functions and the continued prosperity of the College and the Union, which is now entering on its thirtieth year. I am sorry at my inability to be present for the functions.

Mr. A. Ranganatham, Formerly Minister. Government of Madras:

I offer you my warmest congratulations at your capture of Mr. S. V. Ramamurty, I. C. S, as President of the College Day celebration and conference. I know of few who are as devoted as he to the motherland and anxious to give their very best in her service. I wish the conference every success.

His Holiness Kasivasi Saminatha Thambiran:

We wish the function a grand success.

Mr. R. G. Nallakuttalam Pillai, Srivilliputhur:

Wish the conference every success.

Mr. M. R. V. Panikkar, Principal, Madras Veterinary College;

I regret my inability to be present on the occasion, but I wish the celebrations all success.

Rao Bahadur A, K. Menon, Superintendent, Kerala Soap Institute, Calicut:

I regret my inability to be present, but I wish the function all success and continued prosperity for your association.

Dr. C. N. Acharya, Indian Institute of Science, Bangalore:

Though I regret my inability to be present on the occasion, my best wishes go out for the success of the function. I note from the programme that you are arranging for a symposium on 'Soil erosion' and wish that increasing attention may be paid to such scientific discussions in future years, with special reference to the conditions existing in this province.

Report of the Managing Committee of the Madras Agricultural Students' Union, Coimbatore for the year 1939—'40.

(Presented on the opening day of the Conference.)

Mr. President, Ladies and Gentlemen,

The Managing Committee of the Madras Agricultural Students' Union beg to present their report for the year 1939–'40.

The Union is extremely fortunate in having Mr. S. V. Ramamurty, a distinguished member of the Indian Civil Service, to preside over the deliberations, of this—the twenty-ninth College Day and Conference. Mr. Ramamurty is no stranger to this gathering and to the Agricultural Department. As the Director of Agriculture, he has been responsible for the development of the Department to a remarkable extent. Let me, on behalf of the committee, thank you, Sir, very sincerely for readily accepting our invitation to preside over this Conference, in the midst of very strenuous duties and numerous calls on your time.

We also take this opportunity of welcoming our new Director of Agriculture, Mr. A. R C. Westlake, I. C. S., to our midst and we are confident that under his able guidance the Department will continue to progress.

The year under report has been a very eventful one in the annals of not only our country but also of all the peoples of the world. Although, we, as a body of workers in the field of Agriculture, are not directly concerned with the march of world events, we cannot ignore the tragic happenings in the West. The fate of civilisation and of mankind, not only of the European countries but the entire nations of the world, is hanging by a thread and that thread is the might of the British Empire, or perhaps more appropriately, the right of the British Empire. Britain has taken to arms on a noble cause, to preserve humanity from destruction and degradation and the Union prays and hopes that the Almighty will bless mankind and that the cause of justice will prevail in the end.

The European war is bound to have its repercussions on every nation on the globe and at a time of war, all industry, commerce and agriculture of a country, get paralysed, resulting in total economic upheavals, as the stress of war continues. In recent years, we, in India have considerably increased our out-put of cotton, jute, rice, sugar and groundnut. But at the present time, due to the practical closure of continental markets and the consequent difficulties of exporting these commodities overseas, combined with the high railway freights for the internal movement of produce, both the external and the internal trade of India have been adversely affected. It is at this time that a better utilisation of raw products for industrial purposes in India, has to be seriously considered. Let us now take for instance some of our existing difficulties in regard to a few of our more important crops. India produces a large quantity of short staple cotton which is purchased only by Japan at a price dictated by her. To get over this helplessness, we are not able to augment our area under, and production of, long staple cotton owing to climatic and geographical factors. Under these conditions, the utilisation of short staple cotton for industrial purposes in this country, needs investigation. The Indo-Burman relationship stands in the way of our securing a fair price for our rice. The banning of the export of surplus Indian Sugar by the International Sugar Syndicate, has given a severe set-back to an otherwise flourishing industry. We are however, glad that the Ministry of Food in Britain has decided to purchase one lakh of tons of Indian sugar, out of an estimated surplus of nearly 5 lakhs of tons. Although large stocks of ground nut, coffee, and tobacco are held up in the country at the present time, for want of export facilities as a result of the international situation, we are glad to note that the Government are taking all possible steps for the proper disposal of these products to give relief to the ryots. The country awaits eagerly, the recommendations of the Board of Industrial Research, the National Planning Committee and such other bodies, to solve many of the existing hardships. The Union hopes and trusts that at the end of the war, this country will find itself in a very advantageous position in regard to her agriculture and prime industries.

Agricultural Graduates. The Union respectfully begs to bring to the notice of the Government and the landed aristocracies of this province, that at present, about 100 graduates in Agriculture from this College, are without employment and about 30 to 35 are added to this number every year. While we are painfully aware of the fact that the provincial Agricultural Department will not be able to absorb all the graduates, we could humbly suggest that in view of the splendid practical and scientific knowledge attained by them, compared with other graduates, they may be employed in preference to others, in Education, Cooperative and Revenue Departments. We are sure that an Agricultural graduate as a Cooperative Inspector, a Revenue Inspector or as a teacher of science subjects in schools, is distinctly at an advantage than his compeers from the Arts Colleges. We earnestly appeal to the Government and to the landed aristocracies, to utilise the services of these young men, full of hope and prom ise

College Day and Conference 1939: The Celebration of the Annual College Day and the organisation of an Agricultural Conference form one of the most important functions associated with the activities of the Union. Founded in the year 1911, the Madras Agricultural Students' Union is today celebrating its 29th anniversary. Twenty-nine years is but a considerable period in the life of an organisation, and like many other institutions that stand for national solidarity and the betterment of life, the Union has passed through various phases and vicissitudes in its affairs. Although it is run entirely by a non-official agency, the Union stands today as the foremost medium of the department as a vehicle of thought and a promoter of the cause of scientific agriculture in this Presidency. The Union only wishes that it had the financial support of the

Government which is lacking, to make it more useful and be of greater service to all those that have the cause of better agriculture in their minds.

The twenty-eighth College Day and Conference was celebrated last year from the 13th to 16th July under the distinguished presidency of the Hon'ble Mr. V. V. Giri, Minister for Industries and Labour. The conference was attended by many distinguished visitors. Fifteen papers dealing with a wide range of agricultural subjects were read and discussed.

On the 13th night, the members of the Union entertained the President of the Conference and other visitors by staging dramas and humorous scenes in English, Tamil, and Telugu. The Annual athletic sports were held on 15th July 1939 and Mrs. D. D. Warren kindly gave away the prizes.

As usual an agricultural exhibition depicting the various activities of the Department was held in the Freeman Building for the benefit of the visitors and the public.

The Madras Agricultural Journal. The publication of the Journal is the most important activity of the Union. The Journal which was published regularly every month, continued to maintain a high standard of excellence in scientific journalism and it is a matter for gratification that its columns are being sought not only by the research workers in the different departments and institutions but also by the public who are interested in scientific agriculture. In view of the useful services rendered by the Journal to the cause of Indian agriculture, may we repeat our request to you sir, and through you to the Government of Madras to kindly consider the grant of a subsidy to the Union, to enable it to be of greater service to the country.

Our Members. We have great pleasure in recording that the services of one of our members, Rao Bahadur T. S. Venkataraman, C. I. E, Government Sugarcane Expert have been extended in view of the valuable work that he is now engaged in. We congratulate Dr. R. Sankaran, and Dr. N. Parthasarathy, who have been appointed as Cotton Botanist in Sind, and Sugarcane Geneticist under the Government of India, respectively. We are glad to record that Rao Sahib Dr. T. V. Ramakrishna Ayyar, our member was chosen as the President of the Agricultural section of the Indian Science Congress held at Madras in 1940. It is also gratifying to note that two of our members Messrs. K. Ramiah, M. B. E. and Rao Bahadur Y. Ramachandra Rao have been chosen as the Presidents of the Agricultural and Entomological sections respectively of Indian Science Congress for the year 1941. It gives us great pleasure to mention that Messrs. S. Sundaram and T. Venkataramana Reddy have been awarded the M. Sc., degree of the Madras University and we take this opportunity to record our congratulations to these young men.

Retirement. Since our last report, Rao Sahib G. Jogi Raju Pantulu who was an Assistant Director of Agriculture, has retired from service. Mr. Jogi Raju was a tried and selfless worker and is well known to the members of this Department for his contribution to the advancement of agricultural improvements in this Presidency and we wish him a long and healthy retired life.

Obituary. We record with considerable regret the passing away of Rajah Sir Venganad Vasudeva Rajah of Kollengode, our Patron. We all, miss today the familiar and forceful personality of Rao Sahib T. V. Rajagopalachariar who was snatched away by death on the 8th of March 1940. There was hardly any College Day and Conference in recent years which he did not attend and in the discussions and deliberations of which he did not take an active part. The passing away of Rao Sahib T. V. Rajagopalachariar has created a void in this conference which it is difficult to fill. We take this opportunity to convey our condolences to the members of the bereaved families.

Acknowledgments. It is now our pleasant duty to record our thanks to all those that helped the Union during the year. The Union owes a deep debt of gratitude to the Hon'ble Mr. V. V. Giri, who presided over and guided the deliberation of the conference last year. To the gentlemen who contributed papers for the Conference and to Mrs. D. D. Warren who kindly gave away the prizes for the sports, we tender our sincere thanks. We record our grateful thanks to Mr. P. H. Rama Reddy for the invaluable help rendered by him to the Union and in arranging the conference last year. We cannot adequately thank Mr. R. C. Broadfoot, who as President continued to help the Union in its various activities.

Our thanks are due to all the ladies and gentlemen who in various capacities helped the Union in the celebration of the College Day and Conference last year.

Presidential Address.

By S. V. RAMAMURTY Esq., M. A., I. C. S ,

(*Member, Board of Revenue, Madras*).

Ladies & Gentlemen,

Let me first say that it was with much pleasure that I accepted the invitation of the Madras Agricultural Students' Union to preside over this conference. It affords me an opportunity to renew my acquaintance with a sphere of activity where I myself worked along with you for three years and derived much pleasure and intellectual profit therefrom. The work of the Agricultural Department gives its scientists a happy way of blending a pursuit of pure truth with activities of practical value. Many of us who are interested in pure knowledge while at universities become engaged in work of purely utilitarian value, thereby ignoring lines of thought and aspiration which we pursued as students My own sphere has been mainly in the field of Revenue and Magisterial administration. But pure science, the vision of the world it gives, the zest of intellectual adventure and creative opportunity it provides has always retained its attraction for me and it was eagerly indeed that I caught up the knowledge which the Agricultural Research Institute had gathered and the methods of work it pursued. I was in the happy position of being not merely the head of an agricultural department but of one which was among the most alive of the agricultural departments of India. The keenness of work displayed by several of your research officers could be matched in India only, I think, in the Punjab. One may be permitted to think that in science, as in other departments of life, Madras and the Punjab share a happy balance of idealism and realism.

I had the opportunity too of enhancing my experience of agricultural science not only in India through the meetings of the Imperial Council of Agricultural Research in the palmy days when Sir T. Vijayaraghavachariar moulded its life and built up its vigorous traditions but also by a journey in Europe which I devoted mainly to an exploration of agricultural developments in the countries where science and organisation were most insistently applied to Agriculture. This experience I enjoyed in itself and as I gained it. Later it became part of my equipment which I found very helpful when

as Commissioner of Land Revenue and Irrigation I had to deal with problems relating to the qualitative use of land and water. Most knowledge is pleasurable and in the long run, it is also useful.

I have been recently reading some of the annual reports of the Madras Agricultural Department. I was glad to see that the lines of work with which I was familiar, some indeed of which I helped to introduce myself, have received the fostering care of successive directors and have made creditable contributions to the welfare of the population. The old lines of criticism are, however, still heard. We have advocated in the past as now that there is a need for intelligent young men to go back to land. This does not mean that our agriculture has scope for finding occupation for a larger part of the population than now. It only means that our agriculture has need for greater intelligence to be devoted to it than now, when a person who cannot possibly get on in a town drifts back to a village and to land. On the other hand, the fact that agriculture hardly pays the population that is engaged in it is not a condemnation of the efficiency of its practical methods. What is wrong with its practice is due to its economics and the economic organisation of the country. I have had occasion to take what I call economic soundings in villages in different districts in the presidency. My general conclusion is that two-thirds of a village population has land which gives half an economic holding for each family, the remaining one-third being labourers. To the owner of land, his holding on the average gives Rs. 5 a month of grain and that stands between the family and starvation. In a poor district, a family requires another Rs. 5 a month and in a medium district another Rs. 10 a month. This is made up in various ways where possible—by working as a labourer or as a bandy driver or as a petty shop-keeper. If the land in a village is divided into economic holdings, one-third of the population will have neither land nor labour and this can be tolerated only if industrial development in the country absorbs one-third of the village population, thereby producing an even distribution of population between agriculture and industry. In the absence of industries to absorb surplus village population, more people than land needs, must live in villages and the distribution of land among them is such that it just provides an insurance against starvation.

It is against this back-ground that we have to view the prospects of Agricultural development in the country through the help of scientific research. Scientific research in agriculture does not set right the maladjustment between agriculture and industry that there is in the country. It does not make the villager other than the inheritor of poverty and ignorance. It can offer what to each individual is a small improvement but this to the country in the aggregate means a large increase of wealth. The enthusiasm and impetus to organisation in agriculture cannot therefore come as much from the individual agriculturist as it should from the authorities responsible for collective life and progress. On the officers of the Agricultural Department, there is therefore a special duty cast of not only offering valuable

goods but also making the buyer appreciate the value of the goods. Demonstration and propaganda thus take their place side by side with research which by itself is not likely to achieve practical results in this country unlike, say in advanced countries of Europe, where an educated population is ready to take up the valuable information which scientific research obtains, for their needs. The greater, however, the difficulty, the greater must be the zest you can feel in your task. According to each individual and according to his mood, the Agricultural Service offers opportunities on the one hand of forgetting man and peering into the mysteries of the Universe and on the other forgetting all distant ends and helping man to bear his burden of feeding himself and his near and dear ones from day to day.

It is indeed surprising how closely these two apparently opposite ways of occupying one's attention are connected. It was reported some time ago that a Committee appointed by President Roosevelt to make a list of a dozen scientific discoveries which are likely to help in making a social revolution, included in its list the scientific discoveries of Agro-biology. There are two basic formulae on which this science is built. One is that if a cause x produces agricultural produce y (weighed as dry crop), then $\frac{dy}{dx} = c(a - y)$, where c and a are constants. This is a result claimed to connect the quantity of any crop in any part of the world under any climate with the cause which may be amount of water or manure or seed supplied. The formula involves only two constants. One is the maximum of the effect produced by a living agent and the other is a constant set by the environment. The formula is, it seems to me, one of the neatest and yet most comprehensive formulae science has ever discovered. A formula which holds true over an infinite variety of soil, climate and seed seems to me to be almost as wide as a general law of causation applying not merely to plant life but also animal and human life. It seems to me to hold out the hope of what may be called vegetarian science! We know that man can be vegetarian and yet do all the functions which man who may eat any food may do. We can assert this now with greater confidence when even in fighting, brain is even more effective than brawn for the destruction that is often the aim of fighting. Perhaps science can deal with plants and get all the results which any science may get. It may not for instance be necessary to starve or over-feed guinea pigs to find out results in nutritional science. Plants may obligingly take their place. If I remember right, the idea was begun to be used in the Research Institute by Mr Viswanath, now Director of the Imperial Agricultural Institute, whom Coimbatore helped to find himself for the service of India.

The other basic result in Agro-biology that I have referred to is that the maximum of crop which seed of any variety may produce is $\frac{318}{n}$ where n is the percentage of nitrogen in the dry crop. Both these seem to me to

be very valuable formulae which may set the boundaries for the progress that is possible in agricultural science in India. We have the particular danger in India where development of agricultural science has been recent that initial progress may lead to hope of unlimited progress. These formulae of Agro-biology caution us that beyond particular limits, more cause does not produce more effect. We have therefore to be particularly vigilant as to the values of the constants c and a which are imposed by the environment and the individual agent.

In this connection, there is one type of individual agent and one view of the environment which the Agricultural Science has hardly learnt to recognise. The agent is man and the environment is his social and economic environment. If the formula $\frac{dy}{dx}=c(a-y)$ be applied to man himself and x is the amount of knowledge of agricultural science applied to him and y is the amount of welfare drawn out, there are two boundary constants a and c. There is a maximum amount of welfare which knowledge of a particular kind can evolve in an Indian living in this country India with its past and present. It won't do to say that in England or Italy, Englishmen or Italians have so much increase of welfare through the application of agricultural science and so expect the same effect in India. To find the constants a and c applicable to Indians in India in relation to agriculture, this Institute has to study not only plants and insects and animals in relation to soil and climate but also study man in relation to his past history and present environment. I have sometimes said that in Indian agriculture the missing link is man. The considerations I have now advanced confirm my view of your need to study man. In the alternative, the work of those who have studied manures and insects and plants has to be co-ordinated with the work of those who have studied man.

It is indeed a wide range of thought and activity that agriculture offers to its votaries. More than this, it is essential for the nation that one-half at least of its people should be engaged in agriculture so that the nation may feed and live. This thought comes prominently to our minds at a time of war, when country is cut off from country and each nation is thrown on to itself for its primary needs. We have imported during the last year several crores worth of rice which it should be possible to produce in this province itself, with its large and numerous irrigation sources and the long-sustained tradition of rice production. What is needed is a systematic ascertainment of the needs of the province and the planning of how to meet the needs. With the control which the Government have over the use of water and land, there is scope even for a short range adjustment of rice production. The war has also brought to the fore-front the need for a rapid production of commodities for the cause with which India is identified. There is for instance scope for a large extension of the cultivation of pyrethrum and castor. In all these matters, there is a case not only for the execution of

the results of research but also, due to the crisis of the war, for a quick mobility in such execution. For this, the close co-operation of the Agricultural and Revenue Departments as well as of enlightened agriculturists is needed. I trust that the war will produce the stimulus for such a co-operation which can be continued with profit at times of peace.

I have been much interested in that the choice of the special subject for this year's discussion has fallen on soil erosion. This is a subject which in recent years has received considerable prominence in the United States of America and in South Africa and is beginning to do so in India. Soil which Nature has taken centuries to form may be eroded in a few years by a too rapid exploitation. Such exploitation may be intensive or extensive. Over-grazing and intensive mechanical cultivation have laid bare soil to wind and water in tracts of America and Africa colonized by Europe. Soil which has been conserved by a sparse indigenous population is being depleted by the strain of this increased use to which it is put. The result is a threatened reversion to infertility. Expensive measures are being taken in the U. S. A for instance for the conservation of soil. In this country, soil erosion is due mainly to extension of cultivation. For many centuries, a steady though comparatively low physical standard of living has been kept up by methods of cultivation which used soil not with greed but with restraint. Under the impetus of modern agricultural science, we feel that our use of the soil has been too conservative and that there is a case for an increased pace of exploitation. The cultivator in general, however, has not begun to feel and act with us in this direction But with the rapid growth of population as a result of peace and of methods of conserving life, the pressure on the land for food has grown and there has been a marked extension of cultivation. In the Salem District, I found that during the last 50 years, the area of cultivation had grown from about a million acres to a million and a half. The population grew in much the same proportion. Waste land which served as catchment area for rain and for the flow of rain water to tanks has been increasingly converted into cultivated land. The soil of such land has tended to be washed away into tanks. About half the tanks in Salem have lost a third of their capacity for storing water through being silted up. The economy of wet and dry cultivation in villages has thus been disturbed. The drying up of tanks has led to the drying up first of irrigation wells and then even of drinking water wells. Salem was, I found, in the process of being converted into something like the condition of the Ceded Districts.

Not only was waste land in the plains cultivated, cultivation began to creep up hill sides. The scanty soil of the hill side as well as stones and coarse sand began to be washed down. Rain water flowed away rapidly, leading to erosion of the water courses. Certain steps were taken to prevent an extension of such soil erosion in Salem and the extension of these steps to other areas in the Central Districts has been under consideration.

There is danger of soil erosion when new irrigation projects are executed, particularly in country with a sleep slope. The area of the proposed Tungabhadra project is an example. There is special work being done at the Hagari Agricultural Research Station to deal with soil erosion that irrigation in Bellary and other Ceded Districts may produce.

In all these cases, the root cause of the trouble is a lack of balance between what the soil can sustain and what the population demands from it —whether from an increase of numbers or an increase in their standard of living or both. While science can increase the returns from soil by the application of improved physical, chemical and biological methods, there seems to be a limit to the population and the standard of living which the soil resources of a country can sustain. There is indeed a need for a third major formula in Agro-biology which indicates the maximum crop that can be sustained during any length of time even by perfectly fertile soil. It is perhaps a recognition that such a boundary exists that is the secret of long sustained civilizations like India and China. It has been calculated by Agro-biologists that rice is the one crop that can maintain the largest population per square mile. Wisdom in agriculture is apparently part of the essential basis of a harmonious civilization.

It is therefore the task of agricultural scientists not only to teach us to get more from soil when we do not get enough but also to be restrained in our demands on soil and its fertility so that our life and civilization may not be a brief flash but a steady light shining through time. In such a task, I wish the Madras Agricultural Students' Union all success in taking its due share.

List of Prize Winners.

1.	The Robertson prize	E. Jaganatha Rao.
2.	The Clogstoun prize	L. Venkataratnam.
3.	The Keess prize	E. V. J. Cunha.
4.	The Sampson prize	L. Venkataratnam.
5.	The Dewan Bahadur R. Raghunatha Rao prize	M. Ramiah.
6.	The D'Silva Memorial prize	G. Rama Rao.
7.	The Goschen prize	G. Rama Rao.
8.	The Anstead prize	P. Venkateswara Rao.
9.	Rao Bahadur K. S. Venkatarama Ayyar prize	K. N. Doraiswami. C. Sankar Rao.
10.	The Dewan Bahadur L. D. Swamikannu Memorial prize	K. Bhaskaram.
11.	The Certificate course cup	G. Rama Rao.
12.	The Old Cuddapah District Agricultural Association prize	C. Sankar Rao, B. Sc. I N. Bhaskar Reddy, B. Sc. II B. Narayana Reddy, B. Sc. III
13	The Gupta prize	B. Narasimham.
14.	The M. K. Nambiar Memorial prize	G. Rama Rao.

Papers.

First Session—Monday 15th July, 12 noon to 3-30 p. m.

Symposium on Soil Erosion.

1. Land reclamation methods—Sequelae to soil erosion—*M. Satyanarayana.*
2. Forestry and its relation to the problem of soil erosion—*J. A. Wilson.*
3. Prevention of soil erosion on Tea estates in South India—*J. D. Manning.*
4. Soil erosion and the Coffee industry--*W. W. Mayne.*
5. Relative efficiency of roots and tops of crop plants in protecting the soil from erosion—*C. Vijayaraghavan and V. Panduranga Rao.*
6. Soil erosion by surface run-off—*A. Subba Rao.*

Second Session—Tuesday 16th July 1940, 9 a. m. to 12 noon.

1. The Annamalai University colonisation scheme--*C. S. Krishnaswamy.*
2. Tenants' needs and Departmental limitations—*M. Balakrishnan Nair.*
3. Contribution of the Andhras to the economic prosperity of the Pandyan country—the southern districts of the Madras Presidency—*P. R. Subramanya Ayyar.*
4. Preliminary observations on insect free storage of grains *T. V. Subramaniam.*
5. Prevention of the deterioration of seeds in regard to purity and quality *C. Balasubramanian.*
6. The role of "3S" Societies in the cotton tracts of South India *N. C. Thirumalacharya.*
7. Co-operation in Agriculture—*P. V. Krishna Iyer.*

Chairman's Concluding Remarks.

Gentlemen,

I am sure you will all agree that we had a very successful conference. I congratulate the Madras Agricultural Students' Union on the selection of an important subject like soil erosion which is of great importance to the country. We have listened to several aspects of soil erosion—the influence of forests in mitigating the evil and the methods adopted in tea and coffee plantations where the harm done by soil erosion can be very serious but for the very rational methods adopted. We listened also to two papers on the results of the experimental work done at the Dry Farming Station, Hagari one on the comparative effects of raising different crop plants and the other on the results of different mechanical methods adopted to combat erosion. I share Mr. Ramanathan's, disappointment that his favourite crop (cotton) has not scored a high rank among tha several crops whose effects on soil erosion were tested at Hagari (laughter). It is a matter of satisfaction to me that my favourite *Phaseolus trilobus* (pillipesara) has secured a high rank (laughter). Perhaps when these experiments are repeated for some years and the results analysed statistically, the Cotton Specialist may have cause for some satisfaction (renewed laughter).

India is a country where cultivation has been going on for thousands of years and conditions of soil erosion were present right through. It is estimated that cotton has been in cultivation in this country for even 4 000 to 5,000 years; for cotton fibres were discovered in the ruins of Mohanji Daro. If cotton had been grown as long as that, what had happened to the cotton tracts of India during these 5,000 years?

There is need to recast the attitude of science to tradition. Scientists should modify their attitude towards what is usually dubbed as superstition and examine whether there is any scientific basis underlying the superstition. At Madras, I met an Australian lady who was conducting research in agricultural science in an institute near London. She told me that one line of research she was conducting was the effect of new moon, full moon &c. on growing crops. She gave me a copy of her paper in which I found that crops sown at these periods showed significant differences. Tradition was a thing to which the scientist even as the layman ought to pay respect. Tradition was the father of Science even as Poetry was the father of Grammar. Grammar was latently present in poetry; so also science was latently present in superstition. So that, unlike modern children who want to teach their daddies, scientists should pay respect to the cultivator whose knowledge is based on tradition. There is much in the cultivators' work which on verification would give the scientist greater confidence to follow or which on examination may suggest to him further lines by means of which to enrich old practices. It would also help to conserve the knowledge that had gone behind us in order to build up the future.

I was much interested in the work done in the Cotton Specialist's laboratory in crossing Co. 2 cotton with Uganda and the prospects of crossing, *Karunganni* with American cottons The Punjab was forging ahead in raising long staple cotton. But I feel sure that under the guidance of Rao Bahadur Ramanathan and his assistants, Madras would again come up in the race, so that with better conditions of cultivation which nature has provided, it would be possible for Madras to be once more the leading long and medium staple producer in India.

I was greatly interested to listen to the paper on the Annamalai University colonisation. Agricultural colonies had been receiving attention for many years. Mysore, Punjab, Cawnpore, Annamalai and, Travancore had made experiments. The criticism of experienced officers like Rao Bahadur T. S. Venkataraman was that there was lack of adjustment between men available and the economic conditions into which we wanted to fit them. Instead of changing their psychology, I would take Mr Venkatraman's own work and experience as furnishing a remedy to the problem propounded. Just as Mr. Venkatraman brought about a cross between bamboo and sugarcane or between sorghum and sugarcane we want a cross between the rural and urban mentality. One human scientist was able to achieve this in India and that was the founder of the Dayal Bagh. Dayal Bagh is a place where educated men live and live a decent civilised life making both agriculture and industry meet. It is an *agro-industrial* economy which has got the good points of both the village and the city.

I feel that so far as the educated unemployed are concerned, if we want to find an economic life for them, it must be in some kind of hybrid between town and village. The village by itself has not got the amenities

of civilized life, whereas the town has too much of these. While we cannot abolish villages we can atleast reorganise and regroup them and provide for the group what we cannot provide for the individual.

So far as land colonies were concerned I found that where I did not succeed with educated men I succeeded with uneducated men. I am speaking from my experience of the Chintaldevi farm which was offered to Agricultural graduates without any response from them. I conducted enquiries to get land-less labourers to farm this colony. I succeeded because the difficulties which existed in the case of the educated unemployed did not exist in the case of these people. These uneducated men knew cultivation. They already had houses. They had some means of livelihood. Unlike the educated unemployed, they were men accustomed to small returns which land gives. With the application of co-operation to agriculture, it was possible to fit them to the economic conditions of India and to prevent these gifts of land made to the land-less labourers from falling into the hands of the copitalist and the exploiter.

It is necessary and possible for the individual educated man to go to the villages. The way of finding an economic living for him was by *agro-industrial* economy and not merely by *agricultural* economy. This is the view I have arrived at after thinking over the problem and discussing it for some years.

My interest in agricultural science is not only official but also personal. I hope in the coming years not only to continue my personal interest in it but also utilise it in my own official life as Member of the Board of Revenue. I look forward to cooperation from all of you in the work in which you and I are interested (applause).

College Day Athletic Sports

The annual athletic sports run by the Madras Agricultural Students' Union came off on Saturday the 13th July. That mid-July weather in Coimbatore can be anything but dependable proved true again this year. The light showers which began on Friday continued at intervals throughout the night and Saturday dawned with an overcast sky. For once the S. W. moonsoon appeared to have the better say over the optimistic sports committee and carried on its vendetta at regular intervals till about 2—30 p. m. Just as the expectant crowd began to despair of a successful sports meet at 3 p. m. the sun came out from his hiding throwing a vivid light on the arena and with it a ray of hope and good cheer on the competitors and the large congregation of spectators. Precisely at 3 p. m. the bugle announced the commencement of the programme and the rapid change from the erstwhile showery weather to bright sun enabled the spectators to emerge from the safety of their tents to the open and those in the open to discard their macintoshes and umbrellas. Ideal weather prevailed till late in the evening when once again the monsoon had undisputed sway over the night and the whole day following.

One important reform which was introduced for the first time was the change over of the track events from the British to the metric system in conformity with the Olympic standards. The system of awarding marks for the

champion-ship was also altered, the Olympic events alone counting for the award. The competitions were keen though it cannot be claimed that the achievements were of a high order. Only one record was broken, Devadas Kamath clearing 30 feet 8⅝ inches in shot put. For the first time in the history of these sports the championship was shared by two competititors C. V. Govindaswamy and H. N. Kamath each scoring 18 marks out of a possible maximum of 36 marks which an individual could score.

Mr. R. C. Broadfoot in a neat little speech congratulated the competitors and the sports officials on a very successful programme and requested Mrs. K. M. Unnithan to give away the trophies and prizes. At the conclusion of this function Mr. K. M. Thomas, president of the Sports committee proposed a vote of thanks to Mrs. Unnithan. The Union was 'At home' to the ladies and gentlemen who responded to their invitation. The thanks of the Union are specially due to the several gentlemen who acted as sports officials.

The successful conclusion of the day's functions were in no small measure due to the untiring efforts of Mr. H. Shiva Rao, Vice-president of the Students' Club and his band of voluntary workers. The excellent arrangements made for refreshments for the large gathering were in the hands of Mrs. M. C. Cherian and the committee.

List of Prize Winners.

Cross Country Race (5 miles). 1. D. Sundar Raj. 2. R. M. Sastri. 3. M. Doss. Time 38 min. 14 2/5 sec.

Pole Vault. 1. T. Chellapa. 2. C. M. George. Height 7 ft. 11 in.

110 metres hurdles. (The Ramaswami Sivan Cup). 1. D. Narasimhamurti 2. C. M. George. 3. R. M. Sastri. Time 20 2/5 sec.

16 lbs. Shot put. 1. Devadas Kamath. 2. K. M. Somanna. 3, B. S. Krishnan. Distance 30 ft. 8 5/8 in. (new record).

100 metres dash. (The Saidapet Old Boys' Cup). 1. L. Narasimha Rao. 2. C. V. Govindaswami. 3. H. N. Kamath. Time 12 4/5 sec.

Long Jump. 1. C. V. Govindaswami. 2. D. Chinnapa Reddi. 3. C. M. George. Distance 16 ft. 10,3/8 in.

200 metres hurdles. 1. D. Narasimhamurthi. 2. C. M. George. 3. R. M. Sastri. Time 33 1/5 sec.

High Jump. (The Tadulingam Cup). 1. C. Ramakanta Reddi. 2. H. N. Kamath 3. S. Krishnamurti Rao. Height 4 ft. 9 in.

Hop, Step and Jump. 1. H. N. Kamath. 2. C. M. George. 3. D. Sundar Raj. Distance 34 ft. 5 3/4 in.

400 metres race. 1. C. V. Govindaswami. 2. H. N. Kamath. 3. C. M. George. Time 62 2/5 sec.

Javelin throw. 1. K. M. Somanna. 2. D. Sundar Raj, 3. Chinnappa Reddi. Distance 85 ft. 10 in.

1500 metres race. (The Anstead Cup). 1. H. N. Kamath. 2. R M. Sastri. Time 6 min. 33 3/5 sec.

Cricket ball throw. 1. H. T. Monnapa Hegde. 2. H. N. Kamath. 3. K. M. Somanna. Distance 95 yds. 2 in.

Invitation Race (800 metres). 1. J. Christy (Govt. Secondary and Training School). 2. M. Saywell (Stanes European High School). 3. A. Ramaswami (Union High School). Time.

Old Boys' race. 1. A. M. Kulandai. 2. J. Colaco.

4 × 400 metres Intertutorial Relay Race. (The Chunampet Shield). 1. Mr. K. M. Thomas' wards. 2. Mr. P. V. Ramiah's wards.

Intertutorial tug of war. (The Ramnad Shield). 1. Mr. C. N. Ayyangar's wards. 2. Mr. B. M. Lakshmipathi's wards.

Joint Championship. C. V. Govindaswami. H. N. Kamath.

Report of the Managing Committee for the year 1939—40.

(Presented to the general body.)

The Managing Committee of the Madras Agricultural Students' Union beg to present the following report of the activities of the union for the year 1939—40.

Membership. The strength of the Union as it stood on 31st May 1940 was 503, as against 450 of last year. It is gratifying to note that this is the highest membership on record ever since the inception of the Union. Indeed it should have given us great pleasure to record this appreciable increase in strength but for the fact that a large number of officers of the Department (nearly 40%) are still not members of the Union, in spite of our very earnest endeavours in the form of personal appeals and despatch of complimentary copies of the Journal to over 150 officers of whom only about 15 enlisted themselves as members during the year. In this connection the managing committee have great pleasure to record their gratefulness to Sri. M. Anandan, one of our members who has been responsible for enlisting six more members during the year. We hope that his example will be followed up by other members. We take this opportunity to appeal to all the officers who are not members already, to enlist themselves and also help in securing more members in the future. We would also request the students that pass out of the College every year to continue to retain their membership, as they get the exclusive benefit of concession rates till they are employed.

Office bearers. There has been no change in the office bearers of the Union during the year. The vacancy in the list of resident members of the council caused by the unfortunate demise of Rao Sahib T. V. Rajagopalachariar was not filled up.

General Body meeting. There has been no occasion to call for a general body meeting during the year. A meeting of the resident members was held on 13-3—40, when a resolution condoling the death of Rao Sahib T. V. Rajagopalachariar was passed.

Meetings of the Managing committee. Eight meetings of the committee were held during the year.

Madras Agricultural Journal. The Journal continued to be published with unfailing regularity and promptness. Seventeen meetings of the Editorial Board were held during the year. A fairly good number of articles on various subjects was received for publication in the Journal and we have great pleasure to record our thanks to the various authors who have contributed to the success of the Journal. We appeal once again to the officers of the Department to evince greater interest in the conduct of the Journal by sending more popular articles to help the cause of scientific Agriculture. In this connection, particular mention must however be made of the publication of the special number of the Journal with *Students' Annual Supplement*, in March 1940. The publication of this special number was undertaken in accordance with the resolution given notice of by the Managing committee and passed unanimously by the General Body in its meeting held on 16th July 1939. The monthly publication of 'mofussil news and notes, in the Journal is a new feature introduced during the year and we are glad that the contribution from the districts is appreciated by the readers.

Editorial Board. We have great pleasure in recording our thanks to Mr. K. M. Thomas, Editor and to the other members of the Editorial Board for the able and efficient conduct of the Journal during the year. We also record our appreciation of the promptness of our printers, The Scholar Press, Palghat.

Subscribers. The number of non-member subscribers to the Journal during the year was 215 as against 230 of last year and 180 in the previous year. We request the mofussil members to enlist more subscribers and make the Journal more popular among the people of this Presidency. 32 Journals (Indian and Foreign) as against 30 of last year were on the exchange list.

Finance. The Auditor's report and the financial statements are now presented to you. It gives us very great satisfaction to note that our finances have made a marked progress during the year. From the statement of income and expenditure account you will find that there is a saving of Rs. 503—0—7 as against the excess of expenditure over income of Rs. 130—0—8 in 1938—39. We hope that this satisfactory condition in finance will be maintained in the coming year. An amount of Rs. 800 has been provided for in the budget estimate for 1940—41 for effecting an extension to the Union building. The committee recommends to the general body to pass this amount as extension is found to be indispensible to relieve the existing congestion in the office.

Employment of Agricultural Graduates. We regret to note that the Madras Agricultural Students' Union which also serves as an employment bureau for the Agricultural graduates has not been able to do anything in this direction. We hope that the authorities will take cognisance of the lot of a large number of Agricultural graduates whose education, talents and energy are being wasted.

Ramasastrulu-Munagala endowment. Three papers were received for this competition this year but no prize was awarded, as the judges were of opinion that the papers contributed were not of a high standard. The thanks of the committee are due to Dewan Bahadur D. Ananda Rao, Chairman of the committee, Rao Bahadur K. Gopalakrishna Raju and Mr. K. Ramiah, M. B. E., for judging the papers.

Acknowledgements. It is our pleasant duty to thank the various members of the Union, who helped and cooperated with its activities during the year. We have great pleasure in recording our grateful thanks to the conveners and members of the various subcommittees who whole heartedly helped us in celebrating the College Day and Conference last year. Our thanks are due to Mr. J. H. Longrigg, Principal, of the Forest College, for loaning us tents and chairs. We particularly thank Mrs. M. C. Cherian and Mrs. M. Kantiraj, for arranging the tea on the sports day last year. The Union is greatly indebted to Mr. R. C. Broadfoot, Principal and President of the Union who has been as kind, helpful and sympathetic as ever, towards the affairs of the Union.

K. Sanjiva Shetty,
Secretary
(on behalf of the Managing Committee.)

Annual General Body Meeting.

The annual General Body meeting of the Madras Agricultural Students' Union was held on Wednesday, the 17th July 1940 with Mr. R. C. Broadfoot, President of the Union in the chair One hundred and forty one members including 64 students were present.

The minutes of the previous meeting were read by the Secretary Mr. K. Sanjiva Shetty. This was adopted. The annual report including the statements of accounts for the year 1939—40 was then presented before the meeting. In considering the budget for the year 1940—41, Rao Sahib V. Muthuswamy Ayyar proposed that provision may be made in the budget for the contribution of a sum of Rs. 25/— to His Excellency the Governor's War Fund, for Indian defence purposes. This was seconded by Rao Bahadur V. Ramanatha Ayyar and was

unanimously passed by the house. Rao Bahadur V. Ramanatha Ayyar then suggested that the charges under 'Establishment' be debited to the journal account, as the establishment was maintained more for the sake of the journal than for other purposes. Mr. M. A. Sankara Ayyar pointed out that the establishment was maintained for the work connected with the membership of the Union and for keeping accounts and the actual work done by the establishment for the printing of the journal was proportionately small. Mr. M. C. Cherian suggested that 50 per cent of the cost of the establishment be debited to the journal account and the rest towards the office expenditure as usual. This was agreed upon. Rao Bahadur V. Ramanatha Ayyar wanted to know the extent and nature of improvements contemplated for the union building for an estimated expenditure of Rs. 800/— during the year 1940-41. The Secretary explained that with the estimated amount, it would be possible to provide an extra room of 15' by 12' with verandhas on the front and the rear and that this extension was very necessary to relieve the congestion of space as at present. The estimates were then passed as amended.

The next item in the agenda, viz. subject for the Ramasastrulu Munagala prize competition was taken up for consideration. The Secretary explained to the house that the judges appointed for considering the papers, received for the above competition had remarked that it was very difficult to judge papers on economic enquiries and those bearing on pure research in one and the same year. They suggested that the competition be open for papers on economic enquiries in one year and for research in another. This evoked a good deal of discussion and finally it was agreed that the recommendations of the board of judges be accepted and that these take effect from next year. Rao Bahadur V. Ramanatha Ayyar suggested that this system be adopted for at least three years and this was seconded by Mr. C. M. John. The question of notifying the scope of the competition for the year 1940—41 was left to the discretion of the Managing committee. The resolution was then put to vote and passed unanimously.

The following office bearers were then elected for 1940—41.

Vice President :— Mr. P. V. Ramaiah.

Editor :— Mr. K. M. Thomas.

Secretary :— Mr. T. Nataraj.

Mofussil Vice Presidents :— Messrs. M. V. Raghava Rao, M. Anandan and R. Swami Rao.

Mofussil members for the council:—Messrs. M. Damodara Prabhu, K Jagannatha Rao, A. Muhammad Ali and K. Kuppumuthu.

Resident members for the council :— Messrs. C. Balasubramania Mudaliar, M. S. Kylasam, Rao Sahib V. Muthuswamy Ayyar, and Mr. G. Rama Rao (Student).

Manager :— Mr. K. Ramaswamy.

Treasurer :— Mr. A. M. Kulandai.

Managing Committee :— Messrs. V. Gomatinayagam Pillai, K. Sanjiva Shetty P. A. Venkateswara Ayyar, and T. Chellappa (Student).

Editorial Board :— Messers M. Kanti Raj, M. C. Cherian, Dr. N. Krishnaswamy, and Mr. Narayanamurty (Student).

In winding up the proceedings, the President of the meeting Mr. R. C. Broadfoot thanked all the members of the Union and the members of the various committees for the successful conduct of the college day and conference. He particularly thanked Mrs. M. C. Cherian and the committee for the excellent arrangements they made for the 'At home' on the sports day. He also thanked Mr. J. H. Longrigg of the Madras Forest College for kindly loaning the chairs and tents for the occasion. Mr. M. C. Cherian proposed a vote of thanks to Mr. R. C. Broadfoot for evincing keen interest in the affairs of the Union.

Forestry and its Relation to the Problem of Soil Erosion.*

By J. A. WILSON, I. F. S.
District Forest Officer, Coimbatore.

Introduction. It is impossible in the short time at my disposal to deal fully with such an important subject, for it is one on which a long series of lectures could be given. I have therefore chosen to deal with the subject from a rather unusual angle. I presuppose a general knowledge of the subject among my listeners.

What exactly is soil erosion? Put into the simplest of language it is the gradual wearing away of the soil by the effects of wind and water. We all know that soil erosion is nature's revenge on man for his misuse of land, and that the only remedy against erosion is to stop this misuse, and take steps which we have studied to check this menace where it has already started

Agents of erosion. For soil to waste away, movement must take place, and there must always be a conveying agent, since soil has no automotive power. As stated above the two conveyors are wind and water. The rate at which erosion takes place naturally varies with the type of soil, but is chiefly determined in terms of the velocity of the conveyor If therefore we could control these velocities, we should be able to control erosion. The ignorant may smile at any suggestion of attempting to control climatic factors such as wind and rain, and indeed it is futile to claim that one can bring climatic factors under complete control. Yet it is possible to vary local climatic conditions to an appreciable extent. Any old man of Coimbatore, for example will tell you that the appalling winds which drive us to distraction are much worse now than they were fifty years ago. I have repeatedly heard the view expressed in the Ceded Districts that during the last fifty years the rainfall has become much more irregular and undependable, while such rain as falls, usually falls, as a veritable downpour—excellent for tank filling purposes, no doubt—but bad as being the cause of a good deal of wash and the resulting silting up of tanks. These are impressions, they have so far as I know no foundation in statistical records, for such are kept in very simple form. But old men often think over such matters and their views should not be rejected altogether. There are many indications that the impressions are correct, and that local variations of climate do take place as the years pass. If so there must be reasons for it.

The effects of forests on climate (i). *Wind erosion.* First take the case of the wind. At school we studied cyclones, and anticyclones, the main world air currents such as the monsoons, and trade winds, and their

* **Paper read at the twenty-ninth College Day and Conference of the M. A. S. U. July 1940.**

causes. We studied the question of sea breezes and land breezes. We found that movements of air (winds) took place from regions of high barometric pressure towards regions of low barometric pressure, and we also learnt that hot air rises thus creating low barometric pressure zones. How many of us have been thankful for a cooling sea breeze in our Presidency town, without thinking of what caused it, namely the heating up of the soil during the day, the rising of the air above the hot soil surface, and the resultant inflow of air from the sea.

Winds are however of two types, the main inter-continental currents of the monsoon type and local well known winds of which our Coimbatore wind is a typical example. With the knowledge we have, it is not difficult to realise that the more extreme the limits of the factors which cause winds, the worse the winds will become. It is beyond the power of man to control the main world air currents, but so far as local winds are concerned forests are of some importance. In France, the U. S. S. R. and the U. S. A., a good deal of work to this end actually has been done with some measure of success. Let us consider the action of a forest. First of all a forest offers a mechanical obstruction and reduces the ground velocity of a wind. Everyone of us knows the value of trees as wind-breaks around our villages and farms This is the direct side of the question. There is however a very valuable indirect effect of forests which is apt to be overlooked. Forests obstruct the passage of the sun's rays to the soil and reduce ground temperatures during the day, while at night they tend to moderate the fall in ground temperature. They reduce the temperature of the air around them by virtue of the physiological and physical processes incidental to plant growth. Trees transpire water, and in the process of evaporation much heat is absorbed from the sun's rays. Plant tissues therefore never become heated to the same extent as bare rocks or bare soil. This moderating effect on the extremes of temperature all makes for a reduction in the velocity of local air currents.

It is for these reasons that in the U. S A. a scheme for the establishment of a great central belt of forest was put forward as a cure for the high winds that have developed since large areas of prairie were converted into arable lands for the production of cotton. The devastation wrought by dust storms was so enormous that it was considered sound policy to expend large sums on the planting of this belt of trees. A much older and better known example of tree planting to check winds is that of the French Landes, where thousands of acres have been put under maritime pine plantations, again at enormous cost to the state. In this case, however, the project has proved profitable in the long run apart from having achieved the important object of preventing soil drift and giving security to a large number of cultivators whose lands were previously threatened by shifting sand dunes. Coming nearer home we have several cases of casuarina plantations down the East coast from Ganjam to Tinnevelly established to control sand drift and these also have been fairly successful.

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Modern experience shows however that though regular belts may check sand drift and help to moderate extreme climatic factors the effect is much more pronounced if irregular plantations are established here and there in key positions after a detailed study of local topography, so that the maximum effect of high ground may be obtained. The establishment of plantations in wind-swept areas is not easy, but it can be done, and the cost has to be faced when the alternative is the loss of soil fertility which is the cultivator's basic capital.

Having considered this question of the effect of forests on climatic factors which cause winds and on the winds themselves one cannot but be forced to the conclusion that the alleged deterioration of local climate in parts of Madras is in part the result of the conversion of vast areas of un-reserves which carried a degraded scrub jungle into arable lands, and the denudation and deterioration of many of the hills of Salem, Trichinopoly, Chittoor, Anantapur and the Ceded Districts.

(ii). Water erosion. Now let us turn to the consideration of water, which is responsible for the more spectacular types of erosion with which every text book is filled. We have to consider two aspects of the question, the pulverising effect of the heavy drops in a heavy rainstorm, and the actual carrying away of the particles of soil by the 'run-off'. The pulverising effect of rain depends on the rate of precipitation. A light shower does little damage, while a heavy thunderstorm may cause considerable destruction. The heavy drops pulverise the surface soil particles, and converts them into very fine mud which goes to choke the surface pores. This checks the rate of absorption of moisture and increases the run-off. It has been stated by many that forests tend to increase the rainfall. There is no proof of this and all too much credence has been given to the theory. All available evidence points to the fact that the topography of a country exercises a far greater influence on rainfall than the mere existence of forests no matter how extensive. There is, however, evidence that forests do exercise a limited local effect merely because they lower the temperature of moisture laden winds. What is being repeatedly emphasized is that a judicious distribution of blocks of forest here and there over a country-side does tend to moderate the climate and this effect extends to moderation of the rate of precipitation, since the more extreme the various climatic factors such as temperature, the more severe are the small cyclones that result in the heavy storms which cause the damage.

Let us now pass to the 'run-off' which actually carries with it the soil particles. A light shower causes little run-off even on bare soil. A heavy storm precipitates moisture at a far greater rate than soil can absorb it. Gravity comes into action and the surplus drains off to lower levels. The faster the run-off the more the erosion. Nor does the damage end there, for water charged with soil particles has a pronounced scouring action and so gullies are formed. These in turn are scoured out into ravines and so

develop what the American would call 'bad lands'--useless for cultivation. Ravines it should also be noted cause lateral drainage from surrounding land and result in a fall in the sub-soil water level. These processes start in the hills and their effect is cumulative as we proceed towards the plains.

Now how do forests affect matters? We must remember that most of our forests are on the hills and their effect therefore operates chiefly in these areas. The canopy of leaves first breaks the heavy drops and largely checks their pulverising action on the soil. The dead leaves which go to make up the humus layer help in this for they absorb the force as such drops which penetrate or fall from the canopy hit them. The water runs under the leaves and reaches a soil in which the surface pores are open. Absorption therefore is much greater. As the water is absorbed it is assisted down to the sub-soil strata by the roots of the trees and shrubs and goes down to feed deep seated springs. Run-off is at a minimum, and soil erosion is much reduced. It is not claimed that forests are a complete check on run off, but that they exercise a very moderating effect. This is of the utmost importance in the hills or shall we say in the water catchment areas, and we as foresters do claim that good forests are the best form of check on what has been called 'the march of the hills to the sea'. It is impossible to divorce erosion pure and simple from water conservation when considering this matter, and the one is as important as the other. Without soil we are helpless. Without water we are equally helpless.

Anyone who knows his South India can quote instances of this type of benefit conveyed by forests. Even in Coimbatore District I quote the case of the Bhavani as observed at Satyamangalam. Here it is possible to tell from the colour of the river whether heavy rains have taken place in the Nilgiris or in the heavily forested areas of Eastern Malabar where the river rises. The Nilgiris yield a flow of what is almost liquid mud, while the run off from East Malabar is comparatively clear. Any ryot around the irrigated zone of Gobichettipalayam welcomes heavy rain in the Nilgiris, for he gets from it valuable silt, while the opposite is the view of the irrigation authorities.

Summarising what has gone before, forests reduce extremes of climate whatever factor we may examine, temperature, wind, rainfall, atmospheric humidity or evaporation, and as a result reduce erosion which increases the more extreme the climate. The destruction of forests tends to lead to a deterioration of climate because it makes the climate more extreme. I have previously touched on local impressions voiced by old men. I now quote the example of Mesopotamia, once a rich garden land of plenty supporting a wealthy and happy people, and now a ghastly desert supporting only a sparse poverty-stricken population.

The destruction of forests still continues. To every thinking man this is a matter for serious consideration. We can no longer afford to take a short-sighted view. We have the future of the human race to consider.

Erosion has become a world problem over vast areas. At the same time as we are bringing more and more land into the arable class, more and more land is passing from arable to waste since it has become sub-marginal for cultivation and such land is often in such a condition that it will never again carry a vegetative cover. This cannot go on for ever and the ultimate result can only be starvation.

Forestry and Agriculture are kindred subjects. Each has its place in the economy of a country. There is however a balance between the two and it is to the advantage of the pure agriculturist that this balance should be maintained.

To you agriculturists I say in closing that without wishing to deprecate in any way the ordinary anti-erosion methods which you are taught to adopt on your cultivated lands, you should remember that the forests are also your friends. Their effects are not spectacular, but they are none the less effective, and they are in themselves extremely important agents in checking the most pressing problem of modern times—erosion—the greatest enemy of the human race.

I congratulate the Madras Agricultural Students' Union on its selection of this subject for discussion. It is my fervent hope that the members of this Union who can visualise the dangers of soil erosion to the country, would strive hard at all times to keep the control of erosion as one of the most important objects of their lives.

Prevention of Soil Erosion on Tea Estates in South India.*

By J. D. MANNING, B. Sc. (Agri) Edin.,
U. P. A. S. I., Tea Scientific Officer, Nilgiris.

Introduction. The object of my contribution to your discussions, is to describe, what steps have been and are being taken to prevent soil erosion on tea estates in S. India. In one way tea estates present a special problem, but what I have to say about anti-erosion measures, applies very largely to any form of hill cultivation.

Perhaps there are some of you not familiar with the tea industry in S. India, so I shall begin by saying that there are in Mysore, the Madras presidency and Travancore approximately 160,000 acres of tea. The chief districts in the Madras presidency are the Nilgiris, Wynad and Anamallais. In Travancore state tea is grown on the Kanan Devan Hills or High Ranges and in South and Central Travancore. Mysore and Cochin states have a comparatively small acreage.

Under an international scheme of restriction, practically no new areas are now being planted and the figure of 160,000 acres, remains very

* Paper read at the twenty-ninth College day and Conference of the M. A. S. U., July 1940.

constant. The area hardly falls at all because, odd as it may seem, it does not pay to abandon tea—even the worst tea. Practically the whole of the large acreage is situated on the hill sides and mountain slopes of the Western ghats, and the plantations vary in elevation, from under 1000 feet to well over 7000 feet. Moreover, the tea is planted on land, sometimes very steep, which formerly carried medium to heavy jungle, though there is a certain amount of grass-land tea. Under virgin jungle or grass, the soil is so well protected that soil erosion hardly takes place. But as soon as such land is cleared for planting with a new crop, it immediately becomes liable to erosion, and from the very start the problem of erosion must be faced and tackled or else deterioration of land and crop takes place at a rapid pace. The problem is somewhat intensified because tea requires a fairly heavy rainfall, and in the tea districts we seldom have a rainfall of less than 50 inches per annum, and not unusually it goes to 200 inches and over. Most of this rain falls during the South West monsoon. You will appreciate then, that on hillsides and mountain slopes where there is a heavy rainfall, the prevention of erosion is a matter of the first importance, and particularly so, because tea is a perennial crop and with good treatment, we can expect the same plants to go on producing productive crop, for 70 years or more, provided they are well cared for.

Kinds of erosion. Under the conditions which I have mentioned, three forms of erosion can take place (i) erosion by wind; (ii) gully erosion and (iii) surface wash. The first of these is hardly a serious problem in tea estates; the second—gully erosion—is rather more serious, but chiefly we are concerned with erosion due to surface run-off. When this takes place, not only is the top soil gradually carried away, but with it the soil humus, the soluble nitrogen, the phosphates and potash. None of these valuable constituents we can afford to lose. In this short address, I shall confine myself very largely to erosion by surface run-off because as I have said, this is the type of erosion which presents the real problem.

Surface wash. This surface run-off, takes place chiefly, when the rate of rainfall is greater than the amount of water, that can be absorbed by the soil, at the time of fall. So, unless protective measures are taken, we find during heavy rain that all excess water which is not immediately absorbed by the soil, rush down the slopes and carry with it constituents which make up the top soil.

Principles of Protective Measures The greater the pace at which this water moves down the hill, over the surface, the larger is the quantity of soil that is washed away, so that, all efforts aimed at preventing erosion must be based on two chief principles. The first principle must be to render the soil as absorptive as possible so that it will rapidly absorb a large proportion of the water falling at any given time. The second step is to reduce to a minimum the rate at which any excess water can move over the soil surface. If a very large proportion of the rainfall is absorbed as it falls, and the excess can move but slowly, then erosion by surface run-off is

reduced to a minimum. That represents the ideal set of conditions we should aim at, and now the problem is how to achieve those ideal conditions.

Increasing the absorptive capacity of the soil. I shall first deal with the absorptive power of the soil. It is not possible immediately to change the type of soil but we must see that the soil is kept in good physical condition, has no hard pan either on or near the surface and is well drained. Its power of absorbing water should thus be raised to the maximum capacity. The periodical addition of organic matter, materially helps in increasing the power of absorption. Attention is paid to all these points on tea estates and by adopting them it has been possible to ensure that a large proportion of the heavy rainfall penetrates into the soil. But such methods, which after all are only good farming practices, are insufficient in themselves because during the time of heaviest rains and continual rainfall there is a certain amount of excess rainfall, and it is the steps, taken to deal with this latter mass of water (1" of rain = 110 tons of water per acre) which finally decides how much erosion does take place.

There are several methods which decrease the speed of movement of excess water and thereby decrease the rate at which the surface soil can be moved. Moreover, the slower the movement of excess water over the soil surface, the more time there is for the soil to absorb this water.

Protective measures. The methods resorted to, on tea estates are:—

(i). *Terracing.* I expect you all will have seen terracing done at some time or other, and in any case it is adequately dealt with in many text books. Terracing is most effective when it is so supported as to be permanent, and its main feature is, that it tends to convert a hill-side into a series of flats and thereby reduces the rate of surface run-off. It is effective, especially if done on contour, but it is an expensive method. Since we have other methods which are as good and somewhat less expensive, terracing is not an universal feature of South Indian tea estates.

(ii). *Maintaining surface drains.* There are various systems of surface drainage and great use is made of such drainage systems in South Indian tea estates. One usually thinks of drains as being a means of carrying away water as quickly as possible, but for purposes of control of erosion their use has been modified so that the anti-erosion drains have come to mean drains which collect excess surface water, and move it off as slowly as possible. These drains really are very effective, and especially so, if they are not too far apart and are well designed so that water cannot travel far, over the soil surface before it reaches a drain, and when it does reach a drain the slope is so gradual that its rate of movement in the drains is reduced as far as possible. In many cases it is the custom to have ordinary surface drains well placed, gradually leading the water away, but more often than not, modifications have been made in the drains themselves to reduce still further the rate of water movement. One of these modifications entails digging "silt pits" in the drains every few yards. This reduces the rate of

movement, and facilitates deposition of silt in the pits. Later, the soil so collected, can be spread back, on the land from which it has come—always on the upper side of the drain. A second modification is what is known as a "lock and step" drain. This is no more than an ordinary drain with a series of steps and locks whose purpose is to reduce the speed of water movement thereby allowing the soil carried by the water, to settle in the drains, eventually to be replaced on the land. There are still more modifications of this method but suffice now to say that these drainage systems are effective methods of preventing soil wash.

(iii). *Raising shade trees and cover crops*. Finally, I want to mention what I consider to be the most effective method of controlling erosion. It amounts to no more than seeing that the soil is never bare and exposed. An exposed soil, subject to the heavy beating effect of rain, is most liable to erosion. Now it has become almost a fetish on tea estates to keep the land covered and this is done by growing shade trees – which break the fall of rain – and also by growing cover crops between the rows of tea or allowing soft weeds to grow. When by such practices the soil is completely covered on the surface and fully occupied by the root systems of plants, erosion is reduced to a minimum, and it is perhaps the only real way, how the problem can be tackled effectively. I know it sounds all wrong and looks untidy to have a cover of weeds growing amidst tea, and we do know that their presence reduces yield by 5 to 10 per cent. But so much importance is placed on preventing any kind of erosion, that most planters are prepared to sacrifice this loss of yield, to keep their soil intact. Eventually, of course, it pays a handsome dividend to do so. Unlike the annual crops, tea is a crop which can stand a certain amount of weed growth and cover crop, provided always that the weeds are never allowed get out of control and that any harmful weeds are always removed.

Conclusion. It is by a combination of these methods that the problem of soil erosion is being tackled on tea estates in S. India today, and I think I can truly claim for the planters that not only do they realise their responsibility in this direction, but that they have studied the problem intelligently and are putting into practice the most effective measures. After all it amounts to nothing less than that – and it is the message which I should like to leave with you today – there are two ways of managing land, viz. either you can (a) *mine* it—take from it all it will give and take no care for the future; or you can (*b*) *farm* it – treat it intelligently as a living and lasting thing and realise that the land and yourself have a future to think of. Be always suspicious of erosion – it goes on much more rapidly than one would believe by appearances. Regard it as a major problem.

Soil Erosion by Surface Run-off.

By A. SUBBA RAO, D. Sc., F. Inst. P.,
Soil Physicist, Dry Farming Station, Hagari.

Introduction. In the black soil areas of the Ceded Districts conditions are generally favourable for heavy losses of soil and water by surface run-off after rains. Sheet erosion has been responsible for a steady deterioration in the depth and fertility of the soil. The main factors contributing to this are (1) the heavy type of soil—which does not allow the rain water to be absorbed as fast as it is received, (2) the undulating nature of the land and (3) the great intensity of the rainfall. About half the annual rainfall of the tract is received within a limited period of four to six weeks between September and October. Unless proper preventive measures are adopted, most of the rainfall received in heavy instalments is lost as surface run-off carrying with it large quantities of the rich surface soil. A knowledge of the exact amount of soil and water lost by run-off is essential for an understanding of the magnitude of the problem.

Experimental. During the last three years data on the amount of soil and water lost by surface run-off have been collected in plots specially constructed for the purpose.

Two plots $66' \times 8\frac{1}{4}'$ (area 1·25 cents) with a gradient of 1 in 80 were selected. On three sides each plot was enclosed by galvanised iron sheets and the run-off was collected into masonry cisterns towards which the plots slope. The amounts of water and silt collected as run-off were measured after each rain. Samples of run-off waters were analysed for total salts, lime and nitric nitrogen. Nitric nitrogen determined in samples of rainwater served as a correction for the values obtained for samples of run-off. The silts collected in the different seasons were analysed separately. During 1937—38 both the plots were kept under the same treatment viz. hand hoeing by the blade harrow given before the rainy season. The results of the first season served as duplicates.

The effect of Scooping. The effect of scooping the land on the control of the erosion was studied during 1933—39 and 1939—40. In one of the run-off plots, scoops were formed before the rainy season and the amounts of water and silt collected in the run-off tanks after each rain were studied. The results obtained for the last three seasons are summarised below in Table I. It will be seen from the figures that in the control plot 44 and 48 per cent. of the rainfall was lost as run-off during 1937-38 and 1938-39 respectively. During 1939 the run-off tanks overflowed on two occasions and the results given in the table are exclusive of the data on those two days. The silt washed off in the control plot is considerable as it amounted to 6·6, 9·9 and 7·4 tons per acre respectively for the rainfall of 9·2", 15·7" and 8·4" for the three years under study. For every inch of water lost, the amount of

silt carried off was 1·65, 1·31 and 2·69 tons per acre in the control plot for the three years under study. Under the same conditions of gradient and size of plot, 4·3 tons of soil per acre was lost from a clean fallow at the Dry Farming Station, Sholapur, during 1935-36.

TABLE I. Run-off results—Hagari Experimental Station.

	1937—38 Average of two control plots.	1938—39		1939-40 *	
		Control.	Scooped.	Control.	Scooped.
1. Number of days when there was run-off.	11	13	10	16	10
2. Total rainfall on days when there was run-off in either of the plots.	9·16″	15 66″	15 66″	8·36″	8 36″
3. Rainwater lost.	4·00″	7·52″	3 29″	2 73″	1·34″
4. Rainwater lost—expressed as per cent of rainfall received.	43 67	48·01	21·01	32·66	16·03
5 Silt washed off in tons per acre.	6·58	9·86	3·60	7·35	2 44
6 Silt washed off in tons per inch of rainwater lost.	1·65	1·31	1·09	2·69	1·82
7. Total salts lost in pounds per acre.	100·60	132 86	95·79	65·00	41·72
8. Lime (CaO) lost in pounds per acre.	2·45	20·07	16·79	5·46	2·62
9 Nitric nitrogen lost in pounds per acre.	0·11	0 59	0·29	0·19	0·09

* Excluding 2 days when the tanks overflowed—Rainfall being 3·82″ and 2·61″ within 24 hours on 10—8—39 and 25—10—39 respectively.

Intense storms received during a short spell contribute most to the run-off. The pockets into which one of the run-off plots was thrown by scooping, effectively decreased the run-off of water to less than half the value of the control plot, while the silt washed off was only about one-third.

Analysis of silt collected in 1937-38 clearly showed that the soil washed off the land is richer than the original soil both from the physical and chemical point of view as shown in the tables below: —

TABLE II Mechanical analysis of silt collected in 1937-38.

Heads of analysis.		Silt.	Soil 0—1 foot depth. East Block.
Clay	(per cent)	56·8	44·9
Silt	,,	26·9	17·1
Fine sand	,,	8·5	15·7
Coarse sand	,,	1·4	17·5

TABLE III. Chemical analysis of silt cellected in 1937-38.

Heads of analysis.	Silt.	Soil 0—1 foot depth. East Block.
Loss on ignition	7·14	3·12
Insoluble matter	63·95	75·49
Iron and alumina ($Fe_2O_3 + Al_2O_3$)	20·95	13·19
Lime (CaO)	3·83	3·45
Magnesia (MgO)	1·52	0·92
Potash (K_2O)	1·28	0·29
Phosphoric acid (P_2O_5)	0·041	0 054
Nitrogen (N)	0·043	0·024

The mechanical analysis shows that the silt washed off consists of 83·7 per cent. of the fine fractions, clay and silt, while the original soil contains only 62 per cent. The nitrogen content of the silt was 0·043 per cent. while that of the soil was 0·024 per cent. Potash was about four times as much as was contained in the soil. Similarly the 'loss on ignition' is higher for the silt than for the soil. During the course of the washes, the coarser particles settle down and the finer richer material is washed off. The results of the analysis for the silt collected during 1938—39 are in general agreement with the above data. (Data on the run-off for the first two years were published in an article entitled 'Soil and Water Losses by Run-off' in the *Madras Agricultural Journal* Vol. XXVII, pp. 244—246, 1939).

Methods Adopted to Control Erosion. Among the chief methods adopted to control erosion and conserve the rain water may be mentioned (i) bunding the land at regular intervals, (ii) bunding combined with deep ploughing periodically and (iii) scooping the land. The beneficial effect of scooping in checking erosion was shown above. The relative efficiency of the different cultural methods in checking erosion and increasing the powers of absorption of the soil may be seen from a study of the moisture condition of the differently treated plots before and after periods of intense rainfall. The following are a few typical figures for soil moisture which illustrate the effect of cultural treatments on the absorption of rain-water, when it is received in heavy instalment.

TABLE IV. Moisture contents of differently treated soils

Treatment.	Moisture per cent in the layer 0—3 feet			Rainfall absorbed in inches.
	on 16th August 1938.	on 31st August 1938.	Difference.	
		Rainfall between the dates :		6·15"
Control	18·1	22·1	4·0	1·9
Bunded	19·0	24·1	5·1	2·5
Ploughed in March '38 and bunded	17·2	25·1	7·9	3·8
		on 1st Septr. 1938.		
Control	15·3	21·2	5·9	2·83
Bunded	15·4	24·8	9·4	4·51
Scooped with basin lister and bunded	16 6	26·8	10·2	4 90
Scooped with *Danthies* and bunded	15·7	26 4	10·7	5·14

The treatments are most effective in checking erosion, during the first spell of heavy rains and in years of poor rainfall. In years of very good rainfall, however, the effect of the treatments is not so conspicuous in the conservation of rainwater as there is a tendency for the different plots to attain the maximum field capacity; but there is the lasting benefit of saving the soil, which is, otherwise, washed off in large quantities as shown in the earlier part of this note.

EXTRACTS

Fertilizer Placement.

With recognition of the fact that absorption of nutrient substances by plants from the soil was a matter of competition or antagonism between the plants and soil, much attention has been paid to fertilizer placement with the object of giving the maximum advantage to the plant. The subject has been fully investigated in the United States where the superiority of localised applications of fertlisers for crops planted in hills and rows is now widely recognised. One of the main technical problems is the design of an efficient distributor which will sow seed and fertilizer in one operation without damaging the seed. Most writers agree that the fertilizers should be placed in bands near, but not too near, and at the side of, rather than directly above or below, the seed or plant. **Placement in bands under, above, or mixed with the soil around the seed usually delays emergence of the crop and reduces yield.** This is due to the greater tendency of fertilizer salts to move vertically rather than laterally in the soil. Lateral bands allow the seed to develop without coming in contact with salts at a stage in its growth at which high concentrations would be injurious.

The optimal distance of the fertiliser band from the seed varies with the rate of application, the texture of the soil and the sensitivity of the crops. **Under average farm conditions, placement 2 inches from the seed row and 3 inches below ground is satisfactory.** W. S. Blair recommends narrow bands 3 inches from the seed and 2 inches deep in the soil for potatoes, turnips, mangolds and fodder corn. An uncontrollable factor which may cause injury to germination in placement fertilising is the moisture content of the soil. J. A. McMillan and F. Hanley have studied drilling fertilizers with the seed at Cambridge. Barley did better with a moderate dressing of fertilizer drilled down the same coulter with the seed than when an equal dressing was broadcast. Sugar beet was more sensitive than barley to high concentrations of fertilizer salts. It was safer to use separate coulters for fertilizer and seed in order to minimise risks to germination in droughty periods. A. S. Alov obtained two to three times as great an effect with row placement as with broadcasting of complete fertilizers on cereals.

The danger of damage to the seed from contact with high salt concentrations is obviously greatest with soluble fertilizers (generally nitrogenous) and least with those (phosphatic) which are strongly absorbed by the soil. J. B. Hester describes three "systems of nutritional variations" designed to eliminate the differences in the solubility and fixation of three main nutrient elements in fertilizing tomatoes. Superphosphate may be placed immediately under the seeds and nitrogen and potash placed further away and at a later date when the plants are ready to use them; or super-phosphate may be placed in, and the nitrogen and potash broadcast; or complete mixtures low in nitrogen and potash may be placed in the row and side dressed with high nitrogen potash mixtures. Similarly, placement of superphosphate in contact with the seed and nitrogen and potash in side bands, is recommended for potatoes.

J. E. McMurtrey has shown that nutrient deficiency symptoms can be produced in individual tobacco leaves by with-holding the nutrient from a portion of the root system and suggests that placement of different fertilizer ingredients in different bands may not be a desirable practice.—*Soil and Fertilizers* (by G. V. Jacks) 497—498.

Crop and Trade Reports.

Statistics—Crop—Groundnut—1940—Summer and early crops—Condition report. Sowings of the summer crop of groundnut are generally below normal owing to the scarcity of rains, after November whilst sowings of the early crop in the districts of Salem and Coimbatore are above normal due to the good rains received during the period April to June.

Harvest of the summer crop of groundnut has commenced in parts. The yield is expected to be generally normal. The condition of the early crop of groundnut is satisfactory.

The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lb (equivalent to 3,200 tolas) as reported from important market centres on 8th July 1940 was Rs. 4—4—0 in Vizianagaram, Rs. 4—2—0 in Cuddalore, Rs. 4—0—0 in Vizagapatam, Rs. 3—13—0 in Guntur, Rs. 3—11—0 in Bellary, Rs. 3—10—0 in Adoni, Rs. 3—7—0 in Nandyal and Hindupur, Rs. 3—6—0 in Cuddapah and Rs. 3—2—0 in Tadpatri. When compared with the prices published in last report, i. e., those which prevailed on 9th April 1940, these prices reveal a fall of about 32 per cent in Tadpatri, 26 per cent in Guntur, 25 per cent in Cuddapah and Cuddalore, 23 per cent in Nandyal, 21 per cent in Vizagapatam, 20 per cent in Hindupur, 16 per cent in Adoni, 13 per cent in Bellary and 11 per cent in Vizianagaram. *(From the Director of Industries and Commerce).*

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 12th July 1940 amounted to 354,485 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939—40. The receipts in the corresponding period of the previous year were 340,060 bales. 322,300 bales mainly of pressed cotton were received at spinning mills and 90,325 bales were exported by sea while 82,968 bales were imported by sea mainly from Karachi.

(From the Director of Agriculture, Madras).

Correspondence.

To

The Editor, Madras Agricultural Journal.

Tephrosia candida, DC, as an insecticide.

Sir,

It has been found out at the Forest Research Institute, Dehra Dun, that the root-bark and seeds of *Tephrosia candida*, DC. contain *retenone* which, while it is an effective insecticide is non-poisonous to human beings and warm blooded animals. This discovery of a cheap source of this insecticide is of immense value to the Indian agriculturists who are too poor to pay for the costly insecticides imported from foreign countries, though they suffer considerable loss of crop through ravages of insect pests. If this insecticide could be placed in their hands at a low cost or if the cultivators themselves could be encouraged to grow this plant and prepare the insecticide they would readily use them to save their crops.

Tephrosia candida, DC., is a weak shrub, 5 to 8 feet in height with slender, woody, grooved branches clothed with brown or grey persistent velvety hairs. Leaves, odd-pinnate with 7 to 14 pairs of narrowly oblong leaflets 1—2" long which are grey—or white-silky beneath. Racemes are terminal and axillary 3 to 9" long, of pure white or reddish drooping flowers ¾ to 1" long. Pod, 3—4" long, brown, slightly curved and 10—15 seeded.

It is found in the Himalayas, Khasia hills in Assam, Chittagong, Malaya, etc. It is largely grown as a cover and green manure plant among plantation crops in Assam, Burma, Bombay, South India, and Ceylon. In some localities, the plant is popularly called "Boga medaloa" by its Assamese name. It can be easily grown in waste places with some care.

The information on the insecticidal properties of this plant has been the subject of a memorandum recently issued by the Government of Madras.

Madras Herbarium, Agricultural Research Institute, Coimbatore
20th July 1940.

Yours &c.
K. Cherian Jacob.

Imperial Council of Agricultural Research

(From the Government of India)

Publication of monographs. At the 21st meeting held in Simla on June 27, 28 and 29, the Advisory Board of the Imperial Council of Agricultural Research decided that in order to collate the great deal of information which has already been published in reports, magazines and bulletins, monographs should be published on "Rice Breeding and Genetics in India", "Dry Farming", "Rinderpest" and "Animal Nutrition".

Potato growing. The possibility of increasing the production of potatoes in India was discussed. With the entry of Italy into war the supply of seed potatoes to Bombay and to a lesser extent to Sind has been cut off and the possibility of obtaining supplies of seed from Kenya and from other Indian provinces was discussed. The continuation of the Simla Potato Breeding Scheme was agreed to.

Uses of Linseed Fibre. A scheme submitted by the Central Provinces and Berar Government for the commercial utilization of linseed fibre was approved. As a side-line to this scheme comparative trials will be made of hand-scutching, dry-scutching and retting of the fibre. A suitable hand-scutching machine has already been developed and there are prospects that the production of this fibre might become a cottage industry. The fibre is used in the villages for the making of string and rope and is combined with cotton or jute in coarse fabrics. It can also be cottonised, by which process it is bleached, softened and spun into fabrics.

Growing of Mixed Crops. During the discussion of a scheme for research in the Central Provinces and Berar, into mixed farming it was stated that the system of growing mixed crops has proved of great benefit in dry farming, it being found that in the United Provinces where *Arhar* and groundnut are grown together, the *Arhar* is improved in quality and quantity.

The Advisory Board approved of the extension of research in dry-farming in Bombay where four sub-stations are to be set up to try out under cultivators' conditions, the methods evolved at the main research stations. A dry-farming research station is also to be established in the Thar-Parkar district of Sind, which is an area of very low rainfall.

Scheme for Fruit Research. The Advisory Board agreed in principle to the expansion of the work already being done at the Lyallpur Agricultural College on the preservation, canning and drying of fruits and appointed a committee to work out details of a scheme for an All-India Fruit Preservation Station on the lines of the station at Campden, in England.

A scheme of research into the improvement of orange crop in Coorg and into methods of marketing the crop was also approved.

The extension for three years of publication of the magazine *Indian Farming* was agreed to.

College and Estate News.

Students' Corner. At the first general body meeting of the Students' Club held on the 27th June, with Sri H. Shiva Rao, the Vice-President in the chair, the following office bearers of the Students' Club were elected for the year 1940—41.

Club secretary	Sri. N. Bhaskara Reddy.
Games secretary	„ K, M. Somanna.
Tennis Captain	„ H. T. Monappa Hegde
Cricket Captain	„ S. V. Srinivasan.
Hockey Captain	„ D. Chinnappa Reddy.
Foot-ball Captain	„ C. A. Ramakantha Reddy.
Representative for class III	„ S. N. Ramasubrahmaniyam,
Representative for Class II	„ H. Gurubasappa.
Representative for Class I	„ D. Sridhara Sastry,
Badminton Captain	„ A. Subba Raju
Volley-ball Captain	„ S. Krishnamurthy.

It is a noteworthy feature of the current year's elections that almost all the office bearers were elected uncontested.

The inaugural address of the Students' Club was delivered on 17th July 1940, by A. R. C. Westlake Esq. I. C. S, Director of Agriculture, Madras with R. C Broadfoot, Esq., Principal in the chair. The meeting was well attended. The speaker dealt on the literary tastes of the English speaking public, discussed the merits of several authors and recommended a good list of books of literary interest.

Freshers for Class I assembled on 2nd July and the hostel is full. Thirteen students have joined the short course in Agriculture.

The Parlakimidi scholarship. Information has been received that in response to a representation made by the Director of Agriculture, the Government of Madras have modified the conditions of the award of the scholarship for higher studies in Agriculture, at New Delhi as follows:—

"The said scholarship shall be awarded to a native of any of the Districts of Vizagapatam, East Godavari, West Godavari, Kistna, Guntur, Nellore, Cuddapah, Kurnool, Anantapur, Bellary and Chittoor, who is

(1) a graduate of the College of Agriculture, Coimbatore with special distinction in Agricultural Botany. or

(2) an upper subordinate of the Madras Agricultural Department, who has served in that Department for not less than five years and has shown during that period special aptitude for scientific research, in agriculture.

The Association of the Upper Subordinate Officers of the Madras Agricultural Department.

The Annual general Body meeting of the above Association was held on the 4th July 1940, in the Agriculture Lecture Hall of the Freeman Building, with Sri. D. Marudarajan, President, in the chair.

The Minutes of the last General Body meeting were read by the Secretary, Sri. P. A. Venkateswaran and adopted by the General Body. The Annual Report for 1939–40 was then presented. This was also adopted unanimously.

The letter No. 16074/40—1 dated 10th July 1940 received from the chief Secretary to the Government of Madras was next considered and the following resolution, moved from the chair, was passed unanimously:—

This Association wishes, in response to the letter No. 16074/40—1, dated 10th July 1940, from the chief secretary to the Government of Madras, to express the whole-hearted support and cooperation of the members of this Association in the endeavours of His Excellency the Governor of Madras and the Secretary be authorised to communicate this resolution to the chief secretary to the Government of Madras.

The following office-bearers were elected for the year 1940–41.

Sri. D. Marudarajan	*President.*
„ M. S. Kylasam	*Secretary.*
„ V. V. Rajagopalan „ C. Balasubramaniam „ P. A. Venkateswaran	*Members of the working committee.*
„ V. Gomathinayagam Pillai	*Auditor.*

M. S. Kylasam proposed a vote of thanks to the retiring committee. The meeting then adjourned to tea.

Weather Review—JUNE 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	10·6	+4·8	31·6
	Calingapatam	4·3	+0·4	20·1
	Vizagapatam	2·4	−2·5	13·8
	Anakapalli*	5·3	+0·8	20·0
	Samalkota*			
	Maruteru*	4·0	+0·3	10·4
	Cocanada	7·2	+2·4	17·2
	Masulipatam	1·5	−3·0	5·3
	Guntur*	4·6	+1·1	10·2
Ceded Dists.	Kurnool	3·1	+0·7	7·8
	Nandyal*	0·0	0·0	0·0
	Hagari*	1·3	−0·6	10·8
	Siruguppa*	2·6	−0·3	7·1
	Bellary	1·7	−0·2	10·9
	Anantapur	1·0	0·0	5·5
	Rentachintala	0·0		0·0
	Cuddapah	5·6	+2·7	15·8
	Anantharajupet*	2·8	+0·6	9·8
Carnatic	Nellore	1·2	0·0	11·7
	Madras	1·0	−0·9	7·0
	Palur*	0·9	−0·9	4·4
	Tindivanam*	3·4	+1·2	8·4
	Cuddalore	1·4	−0·1	5·4
Central	Vellore	4·2	+1·9	8·9
	Salem	4·0	+1·0	16·4
	Coimbatore	1·0	−0·7	14·0
	Coimbatore A. C. & R. I.*	2·2	+0·7	10·8
	Trichinopoly	3·5	+2·1	9·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	1·3	0·0	4·0
	Aduthurai*	2·6	+2·2	8·7
	Madura	4·0	+2·6	12·6
	Pamban	2·8	+2·6	11·5
	Koilpatti*			
	Palamkottah	0·3	−0·2	7·0
West Coast	Trivandrum	18·2	+4·8	32·4
	Cochin	24·8	−3·7	39·8
	Calicut	26·9	−7·1	35·8
	Pattambi*	18·2	−5·7	25·9
	Taliparamba*			
	Kasargode*	34·9	−3·4	42·5
	Nileshwar*	38·6	−2·2	47·0
	Mangalore	28·1	−8·7	34·8
Mysore and Coorg	Chitaldrug	2·9	0·0	8·6
	Bangalore	4·7	+1·8	14·0
	Mysore	4·9	+2·0	13·7
	Mercara	37·6	+11·2	47·7
Hills	Kodaikanal	5·7	+1·6	24·2
	Coonoor			
	Ootacamund*	10·0	+3·7	24·5
	Nanjanad*	11·2	+3·9	21·6

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

General. A temporary advance of the monsoon occurred on the west coast on the 5th of the month, but has not maintained. An advance again took place on the 14th which extended into western Deccan by the 17th and the monsoon continued to be fairly active till the end of the month. Conditions became unsettled in the north of the Bay on the 22nd and a depression appeared on the 24th which, developing into a cyclonic shower crossed the Orissa coast on the 26th and traversing the north of the Peninsula disappeared in the west Central Provinces on the 27th. Another depression appeared over the head of the bay on the 30th.

Rainfall was general over the presidency, and above the average except on the Malabar coast and locally in the Ceded districts and Circars. Other climatic elements were normal.

The chief falls reported were:

1. Mercara.	...	6·3	(28th).
2. Alwaye	...	6·0	(8th).
3. Mercara.	...	5·9	(27th).
4. Trivandrum.	...	5·6	(14th).
5. Cochin.	...	5·6	(7th).
6. Calicut.	...	4·7	(23rd).
7. Cuddapph.	...	3·5	(15th),
8. Gopalpore.	...	3·4	(25th).

Weather report for the Research Institute Observatory for June 1940.

No. 6/40.

Absolute maximum in shade	...	...	95·0°F
,, minimum ,,	...	...	71·0°F
Mean maximum in shade	...	...	88·9°F
Departure from normal	...	...	+0.1°F
Mean minimum in shade	...	...	73·4°F
Departure from normal	...	...	+0·3°F
Total rain for the month	...	...	2·18 inches.
Departure from normal.	...	...	+0·70 inches.
Heaviest fall in 24 hours during the month			0·65 inches on 24th.
Total number of rainy days	...	...	3
Mean daily wind velocity	...	...	4·2 m. p. h.
Departure from normal	...	...	−3·2
Mean humidity	...	...	72%
Departure from normal	...	...	+2·5%

The local thunderstorm showers continued till the 3rd week of the month when the regular south west monsoon set with the characteristic south westerly wind. The temperature for day and night remained normal. Humidity was in excess of the normal as also rainfall.

P. V. R. & T. S. L.

Departmental Notifications.

Gazette Notification.

1. Posting.

Name of officers.	From	To
Sri K. Raghava Acharya,	Asst. Director of Agriculture (on leave),	Asst. Director of Agriculture, Cuddapah.

Subordinate Services.

1. Transfers.

Name of officers.	From	To
Sri K. Dorai Raj,	Offg. Asst. in Chemistry, Coimbatore,	Offg. Asst. in Paddy, Coimbatore.
,, R. Soundararajan,	Offg. Asst. in Cotton,	Offg. Asst. in Chemistry, Coimbatore
,, T. Lakshmipathy Rao,	A. D., Kovuur,	A. D., Bhimavaram.
,, Ch. Venkatachalam,	A. D., Bhimavaram,	A. D., Kovuur.
,, M. Somayya,	A. D., (on leave),	A. D., Bhimilipatam.
,, D. Hanumantha Rao,	A. D., (on leave),	A. D., Pithapuram.

„ M. Satyanarayana,	A. D., Pithapuram,	F. M., A. R. S., Samalkot.
„ P. Lakshminarayana,	A, A. D., Ramachandrapuram,	A. A. D., Cocanada.
„ D. Panakala Rao,	A. D., Cocanada,	A. D., Ramachandrapuram.
„ S. Ponnuswami Naidu,	A. A. D„ Ambasamudram,	A, A. D., Parmakudi.
„ I. Kurma Rao,	A D., Gudivada,	A. D., Sompalli.
„ C. Sitarama Sastri,	A. D., Repalle,	A. D., Gudivada.
„ M. L. Narayana Reddy,	A. A. D., Palakonda,	A, A. D., Anakapalle.
„ M. Gopala Rao,	A. A. D., Tekkali,	A. A. D., Vizianagaram.
„ V. N. Subbannacharya,	Offg. Asst. D. A., Cuddapah,	A. D„ Proddatur.
„ M. K. Gopalan.	A. D., Proddatur,	A. D., Rayadrug.
„ M. Krishnaswami Iyengar,	A. A. D., Rayadrug,	A. D., Dharmavaram.
„ K. Purushottam,	A. D., Guntakal,	A. D., Gooty.
„ S. Lakshminarayana,	A. D., Nandyal,	A. D., Pathikonda.
Janab Shaik Hussain Sahib,	A. D., Pathikonda,	A. D., Anantapur.
Sri S. Krishnamurthi Rao,	A. D., Anantapur,	A. D., Kudligi.
„ V. V. V. Suryanarayana,	A. D., Cuddapah,	A. D., Sidhout.
„ S. Veeravaradaraju,	A. D., Madurantakam,	A. D., Trivellore.
„ S. Kuppuswami Ayyangar.	A. D., Trivellore,	A. D., Kalahasti.
„ K. Satyanarayanamurthi,	A. D., Madanapalli,	A. D., Kalyanadrug.
„ R. H. Krishnan,	A. D., Sriperumbudur,	F. M. D. F. S., Hagari.
„ R. Shunmughasundaram,	F. M. D. F, S., Hagari,	A. D., Bellary.
„ R. Krishnamurthi,	A, D., Saidapet,	F. M., A. R. S., Nandyal.
„ A. Venkatarangam,	A. D., Nellore,	A, D., Rapur.
„ S. Rama Rao,	A. D., Kovuur.	A. D„ Udayagiri.
„ N. Venkaiah,	A. D., Kandukur,	A. D„ Kanigiri.
„ T. A. Rangaswami Ayyangar.	A. A. D., Arantangi,	A. A. D., Tindivanam.
„ E. N. Rengaswami Ayyangar,	A. A. D., Tindivanam,	A. A. D., Villupuram.
„ T. V. Srinivasacharlu,	A. A. D., Villupuram,	A. A. D., Cuddalore.
„ G. J. Balaraj,	A. A. D,. Pattukottai,	F. M. A. R. S., Aduthurai.
„ A. Shanmugasundaram,	F. M. A. R. S., Aduthurai,	A. D., Pattukottai.
„ K. R. Nagarajan.	F. M. A. R. S., Palur.	A. D„ Arantangi.
„ P. Krishnamurthi,	A. A. D., Narasannapeta,	A. A. D., Salur.

2. Leave.

Name of officers.	Period of leave.
Sri R. Krishnamurthi, A. D., Saidapet,	L. a. p. for 2 months from the date of relief.
„ S. Kuppuswami Ayyangar. A. D., Trivellore,	L. a. p. for 2 months from the date of relief.
„ M. R. Balakrishnan, Asst. in Chemistry (on leave),	L. a. p. on m. c. for 2 months and 11 days from 6--6-40.
„ C. S. Gopalaswami Rao, Mycology and Entomology Asst., Bellary,	L, a. p. for 4 months from 15-7-40.
„ M. C. Krishnaswami Sarma, Asst. A, D., Sattur,	L. a. p on m. c. for 3 months from 26-6-40.
„ M. Jeevan Rao, A. D., Sidhout,	L. a. p. for 1 month from 20-7-40.
„ D. Panakala Rao, A. D., Cocanada,	L. a. p. for 4 months and leave on half average pay for 8 months from 12-7-40.

,, P. Narayanan Nair, A. D., Coimbatore	L. a. p. for 4 months from 15—7—40.
,, D. Shanmugasundaram Pillai, A. D., Aruppukottai,	Extension of l. a. p. for 1 month from 13—7—40.
,, P. Somayajulu, A. D., Salur,	L. a. p. for 60 days from 15—7—40.
,, A. G, Ramaswami, Sub Assistant in Entomology, Coimbatore,	Extension of l. a. p. on m. c. for 2 months from 6—7—40.
,, P. S. Venkatasubrahmanyam, F. M., A. R. S, Tindivanam,	Extension of l. a. p. for 1 month from 30--6—40.
,, P. Govindakutty Kurup, F. M., Pomological Station, Coonoor,	L. a. p. for 2 months from 15—7—40.
,, S. Krishna Nayak, A. D, Kasaragod,	L. a. p. for 2 months from 15—7—40.
,, G. J. Balaraj, Asst. A D., Pattukottai,	Extension of l. a. p. on m. c. for 2 months from 29 -6—40.
,, A. Venkatadri Reddi, Nursery, F. M. F. R. S., Kodur.	Earned leave for 60 days from 7—6—40.
,, C. K. Subramania Ayyar, Sub-Asst. Entomology, Coimbatore,	L. a. p for 1 month from 25—7—40.
,, V. N. Subbanna Acharya, Subordinate Agri. Service.	L. a. p. for 2 months from 22—7—40.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the quarter ending 30th June 1940.

A. Books.

1. *Agriculture in Mysore—2nd revised Edition.* *Mysore Agri. Dept. Pubn.* (1939). 2. *Text Book of Agriculture.* Brash, J. G. (1939). 3. *Agriculture and Farm Life*, Phillips, H. A. et al. (1939). 4. *Statistical Methods with special reference to Field Experiments.* Saunders, A. R. (1939). 5. *Modern Sewage Disposal.* Pearse, L. (Ed.) (1938). 6. *The Peanut Industry: A selected list of references.* Hennefrund, H. L. (1939). 7. *A Survey of the Marketing of Cotton in the Punjab.* Sehgal, L. K. (1938). 8. *Report on the cost of production of crops in the principal sugarcane and cotton tracts in India—Supplement volumes to Bengal, Bihar, Mysore. Hyderabad, Baroda and United Provinces* Impl. Council of Agri. Res. (India) Reports. (1940). 9. *Propagation of Horticultural Plants,* Adriance, G. W. & Brison, F, R. (1939). 10. *Fruit Crops: Principles and Practices of Orchard and Small Fruit Culture.* Talbert, T. J. & Murneck, A. E. (1930). 11. *Methods of Research in Agricultural Economics (Conference Lectures).* Wellman, H. R. (1939). 12. *Financing Agriculture.* Norton, L. J. (1938). 13. *Kenya Colony Land Settlement Committee Report.* Mortimer, C. E. Ch. (1939). 14. *Economic and Commercial Geography.* Dubey, R. (1939). 15. *Vitamin and Vitamin Deficiencies, Vol. I—Introductory & Historical; Vitamin B—1 and Beri-Beri.* Harris, L. J. (1938). 16. *The Chemical Analysis of Foods and Food Products.* Jacobs M. B. (1938). 17. *A Text Book of Microbiology.* Burdon, K. L. (1939). 18. *Micro-organisms and Fermentation—5th Edn. Rev.* Jorgenson, A. (1939). 12. *Plant Biology.* Godwin, H. (1989). 20. *The Genetics of Garden Plants Rev. Edn.* Crane. M. B. & Lawrence, W. J. C. (1938). 21. *The Evolution of Genetic System.* Darlington, C. D. (1939). 22. *Dairy Cattle and Milk Production—III Rev. Edn.* Eckles, C. R. (1939).

B. Special Reports and Proceedings.

1. American Fertilizer Practices (Second Survey). A survey among 32,000 Farmers in 36 states—U. S. A. 1939. 2. Review of the Sugar Industry of India for 1938-39. (Supplement to Indian Trade Journal.) 1940. 3. Review of the Oil Seed, Oil and oil Cake Markets (of the world) for 1939-1940. 4. A Summary of the more important results arrived at or indicated by the Agricultural Stations and Research Officers in the Punjab during 1936-1938. 5. Report of the first Imperial Veterinary Conference 1935-1939. 6 Proceedings of the Rewaiian Sugar Planters' Association 1939-1940. 7. Proceedings of the Annual Congress of the South African Sugar Technologists' Association 1940. 8 Proceedings of the Indian Central Cotton Committee 41st 1940. 9 Proceedings of the 19th meeting of the Advisory Board of the Imperial Council of Agricultural Research 1939-1940. 10. Proceedings of the 2nd meeting of the Crops & Soils Wing of the Board of Agriculture and Animal Husbandry in India held in 1937-1939. 11. Proceedings of the Association of Land-Grant Colleges and Universities. U. S. A. 1939-1940.

C. Ix. Administration Reports of Agricultural Depts.

12. Administration Report of the South Arcot Groundnut Market Committee for 1939-40. 13. Administration Report of the Cochin State Agricultural Department for 1938-39. 14. Administration Report of the Mysore State Agricultural Department for 1937-38. 15. Annual Report of the Coffee Scientific Officer, U. P. A. S. I., for 1938-39. 16. Annual Report of the Assam Agricultural Dept. for 1938-39. 17. Annual Report of the Bengal Agricultural Dept. for 1938-39. 18. Annual Report of the Scientific Officers and Agricultural Station Superintendents of Bengal Agricultural Dept. for 1938-39. 19. Annual Report of the Principal, Nagpur Agricultural College for 1938-39. 20. Annual Report of the Central Provinces and Berar Agricultural Dept. for 1938-39. 21. Annual Report of the Central Provinces and Berar Agricultural Dept. Northern Circle. 22. Annual Report of the Central Provinces and Berar Agricultural Dept. Southern Circle. 23. Annual Report of the North-West Frontier Province 1935-37. 24. Annual report of the Council for Scientific and Industrial Research Commonwealth of Australia for 1938-39. 25. Annual Report of the National Institute of Agricultural Botany for 1938-39. 26. Annual Report of the Palestine Agricultural Department for 1938-39. 27. Biennial Report of the Kansas State Board of Agriculture for 1938. 28. Annual Report of the Agricultural and Experiment Union of the Ontario Agricultural Dept. for 1938. 29. Annual Report of the Imperial Institute, London for 1938. 30. Annual Report of the Imperial Agricultural Bureau, England for 1938-39.

D. Reports of Agricultural Stations:

31. Madras Agricultural Stations—Annual Report for 1938-39. 32. A Review of the work of the Experiment Stations of the Empire Cotton Growing Corporation for 1938-39. 33. Annual Report of the Delaware (U. S. A.) Agricultural Experiment Station for 1938-39. 34. Annual Report of the Hawaii (U. S. A.) Agricultural Experiment Station for 1938-39.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVIII.] AUGUST 1940 [No. 8.

EDITORIAL

The Madras Agriculturists Relief Act. Among recent legislative enactments of the Madras Government calculated to ameliorate the economic conditions of the vast agricultural population, the Madras Agriculturists Relief Act 1938, takes prime place. For sometime past the Government of the province had realised that following several years of continuous agricultural depression, the lot of the small land holders and tenant-farmers was far from enviable. Bereft of other sources of income than the interest in their land, the small cultivators who form the real back-bone of the country, were drifting year after year into a state of indebtedness and consequent ruin. The proverbially usurious rates of interest they had to pay on their borrowings and the exhorbitant rent the tenants had to pay to the big landlords began to result in the inevitable transfer of the land which formed practically their sole earthly possessions. It was at such a critical period, when nothing short of a collossal endeavour and a bold and statesmanlike policy could rescue the small farmer from the clutches of the ubiquitous money-lender or the exacting land-lord, that the Government of Madras introduced in 1937 a bill called the Madras Agriculturists Relief Act. Though the bill was hotly opposed at every stage by the vested interests in the country, it was ably steered through by the popular Government and become law in 1938. As a piece of statesmanlike legislation the Act revealed a commendable insight on the part of the Government into the actual conditions of the small land-holders and tenant-farmers and an earnest desire to help them. While the Act contemplated giving relief to the agriculturists, adequate provision has been made to ensure that none but deserving agriculturists benefit by an arbitrary scaling down of debts. One of the outstanding provisions of the Act is that such debtors as have paid back twice the amount of the principal, would be deemed to have cleared their debts irrespective of any renewed documents executed by them. Again, in the case of debts contracted after 1st October 1932, no debtor is obliged to pay a rate of interest higher than 5 per cent simple interest. In the matter of accumulated arrears of rent, such arrears up to Fasli 1345 (1935-36) will be deemed to be discharged provided the tenant pays the rent due for two years within a specified period. It may be recalled that at the time the bill was on the anvil several doubts and fears were expressed about the propriety of such a legislation and grave consequences were predicted as

the after-effects of such a measure. It was freely expressed that the little money which the agriculturists could hitherto borrow, would not be forthcoming, for the moneyed classes would be shy of investing their capital in such form. The experience gained in the working of the Act during the last two years has, however, belied such fears and it may now be asserted without contradiction that the Act has worked as a boon to a very important section of the population. The extent of benefits accrued can be gleaned from a recent Press communique issued by the Development department. During the 25 months ending with March 1940, 1,32,790 cases were disposed of involving a total of four crores and ninety lakhs of rupees which does not cover innumerable cases voluntarily settled outside law courts. If further proof were needed about the success of this legislation it is afforded in the rapid introduction of very similar measures in some of the provinces and states in India.

The late Maharaja of Mysore. The passing away of Col. H. H. Maharaja Sri Krishnaraja Wadiyar Bahadur, the Maharaja of Mysore on the 3rd of August at Bangalore, marks the close of a long period of 38 years of beneficent and progressive rule of an Indian state by an enlightened prince, saintly ruler and great administrator, of whose achievements India may well be proud. His Highness's administration marks an era of great agricultural and industrial progress in the state, which was the direct result of a wise and progressive policy initiated and fostered by His Highness It was the ruler's aim in life to spread education, to diffuse knowledge and to further industrial enterprise and it may well be claimed that this aim was realised in a measure yet unattained in several parts of India. It was the continued policy of the ruler to carry the fruits of research in modern sciences to the doors of the farmers. His Highness's Government made it a policy to understand the needs of the farmer and to extend their cooperation to him. Bulletins and leaflets in the Kannada language on various agricultural and industrial subjects form a great feature of the activities of the Mysore Government. In the formation of cooperative societies, issue of agricultural loans and establishment of agricultural colonies, the state has attained remarkable success. Various industrial enterprises such as the soap factory, sandal wood oil factory, sericultural development, the Badravati iron works, the Mandya sugar factory, the Krishnaraja Sagara power and irrigation projects and the Mysore Paper Mills are but a few of the many enterprises which were initiated by His Highness and which he lived to see in full fruition. Mysore today moans the loss of her beloved ruler and the *Madras Agricultural Journal* joins her in paying its last tributes to a prince among princes.

Relative Efficiency of Roots and Tops of Plants in Protecting the Soil from Erosion.*

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AND

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Introduction. Since a plant cover, either natural or grown, is the main single controllable factor in erosion, an exact understanding of its effects is very valuable. Attempts to ascertain the rate of erosion of soil protected by both tops and roots of cultivated plants as compared with similar soil free from vegetation, are meagre. An immediate application of this knowledge is found in crop-growing. In the black-cotton soil tract of the Deccan where erosion of soil has become a serious proposition, it is important to know the erosion resistance efficiency of the several crops and crop-mixtures, growing in this zone.

In this tract only *mungari*[1] crops experience rains during their growing period. After the sowing of *hingari*[2] crops usually no further rains are received. These studies were made during the two seasons 1938—39 and 1939 - 40. As these pertain only to erosion, only crops which receive rain during their growth are included. Such of those *hingari* crops as figure in *mungari* mixtures only have been included in these experiments. In Section I a general survey of the relative efficiency of crops and crop-mixtures in protecting the soil from erosion is detailed. Section II deals with their relative efficiency at different stages of growth.

Technique. The technique adopted in these studies was that developed by Kramer and Weaver (1936) at the University of Nebraska, Lincoln, Nebraska, U. S. A. Stout frames 40 inches long and 20 inches wide inside and 4 inches deep were made of teak wood one inch thick. The corners were firmly reinforced outside, by angle irons held in place by screws. The frames were taken to the field and placed over samples carefully selected as representative of the area. Pairs of samples were taken only a few feet apart. Care was taken that the tops of all plants rooted inside the frame were included and those rooted outside excluded. Tops of plants immediately surrounding the frames were then removed. Care was exercised not to damage the plants within the frame. With a sharp mason's trowel the core of soil was cut to a depth of 4 inches around the frame in such a manner that the frame could be forced to this depth in the soil, holding firmly the enclosed sample. Laths nailed to the edges of the frame and between the rows of plants, were used to hold the soil in the frame when it was tilted. The frame was next undermined by digging the soil from the

* Paper read at the Twenty-ninth college day and conference, July 1940.

1. *Mungari* = *Kharif* = Early South west monsoon.
2. *Hingari* = *Rabi* = North east monsoon.

ends and, especially, from both sides in such a manner that a blunt wedge was formed from the soil core protruding beneath the frame. The frame was then carefully tipped on its side, but only after a sufficient excavation had been made so that the tops of plants like *setaria* or *sorghum* would not be crushed against the soil. The excess soil was removed and the bottom very carefully fastened in place while the frame lay on its side. The whole process, apparently so simple, was successfully accomplished after some experience. After the sample was secured, it was transplanted in a normal, erect position.

Since each sample contained 1·85 c.ft. of soil of approximately 175 - 200 lbs. in weight, securing it was arduous and painstaking work. The samples were lightly watered so that no dry soil remained. The frame was then placed lengthwise on a washing rack with a slope of 10°. A second frame of the same size but 12 inches deep was placed upon the first. It was held by a number of braces fitting over the frame beneath. A strip of wood ¾ inch wide was permanently fastened within the frame, one on the lower side of each wall, so that its edge protected the soil in the lower frame. Thus in eroding the soil no water came directly in contact with the sides of the lower frame until at least the upper 2 or 3 inches of soil were removed. A strip one inch wide had been removed from the lower end of the upper frame to permit surface soil to escape during this process, and 4 one-inch holes were bored in the lower end of the lower frame to furnish an exit for the water and eroded soil after the top of the soil had been worn away. Water was supplied from a 800 gallon tank on the top of a 40 feet tower, with the same hose and shower-bath nozzle and at a uniform distance of 2 feet from the surface of the soil. Care was taken to move the hose slowly back and forth in a regular manner so that the stream played for only an instant on any one portion of the soil. Two gallons of water were delivered from the nozzle per minute in 35 streams. Throughout the period of washing the soil, the head of water was maintained at practically the same level by two men operating continuously the hand pump connecting the tank.

The objective sought was to erode the whole surface of the soil as uniformly as possible until the entire sample disappeared. This was especially difficult to accomplish where the soil was protected by a plant cover. If all the soil had been eroded in places, obviously additional water on the bottom of the box would have merely prolonged the erosion time. Consequently, before this point was attained, a helper determined where ridges and columns of soil were holding longest and the operator directed the stream of water upon them. The necessary uniformity of method, essential to consistent results, was attained by the same investigator directing where the stream should fall.

Roots and other underground plant materials were caught upon a large copper screen with close meshes, attached near the end of the box and through which all of the water and eroded soil had to pass. The duplicate samples gave fairly similar results showing the accuracy of sampling. The

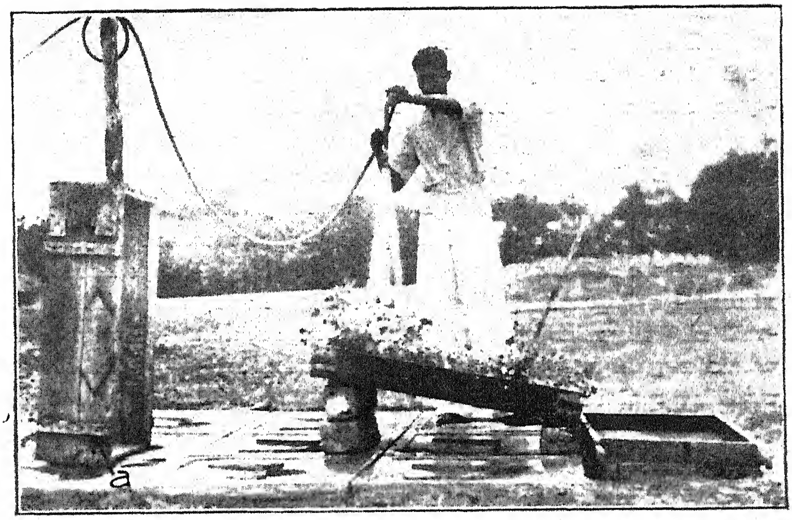

Illustration showing the technique adopted in studying the relative efficiency of crops in protecting the soil from erosion.

The second frame (a) is placed on the frame with the soil and crop while washing and is of the same size.

tops and roots of plants so secured were again carefully washed and each secured separately. The volume of roots in each sample was determined by displacement of water in a cylindrical graduate. The tops and roots were separately dried in a steam oven and the dry weights recorded after cooling in a desiccator.

I. Relative Efficiency of Crops and Crop mixtures in protecting the Soil from Erosion.

(a) *Sorghum—groundnut mixtures.* Sorghum and bunch variety of groundnut *(Arachis hypogea)* were sown in the following proportions: (1) sorghum—groundnut (1:1): (2) sorghum in between rows of groundnut. The groundnut crop was sown in August and sorghum in October and at the time of sampling the former was 90 days old and the plants 16 cm tall. The sorghum crop was 45 days old with a height of 23 cm. In the mixture in which sorghum was sown between rows of groundnut the time taken for completely washing the soil in the frames was 67 minutes. The erosion ratio for this mixture was 1:2*. In the mixture in which sorghum lines alternated with those of groundnut, the time taken was 63 minutes, the erosion ratio being 1:1·9. The effect of these mixtures in protecting the soil from erosion is similar.

(b) *Groundnut-pure (bunch):—* In the pure crops, groundnut grew to a height of 30 cm. and the plants were very bushy. This bushy growth, however, did not prevent water from reaching the ground through the interstices of leaves and branches. The soil was easily eroded as the root-system did not ramify the soil well enough to bind it. But for the soil protected by the lodged leaves and branches, the rest of it was easily eroded. All the soil was completely washed away in 112 minutes, the erosion ratio being 1:3·4.

(c) *Sorghum-pure :—* The plants were in shot blade with a height of 100 cm. Though the broad, swaying leaves considerably checked the beat of the water, the thin stand of the grain crop could not effectively prevent water from reaching the soil surface. Erosion occurred fairly quickly, though the thick crown roots held the soil for some time. The lodged leaves also protected the soil. All the soil in the box was washed away in 123 minutes, the erosion ratio working out to 1:3·7.

It will be seen that pure crops of sorghum and groundnut are more effective in protecting the soil than mixtures of these. This is so because pure crops are better and more vigorously grown than the crops sown mixed, and between the two pure crops there is not much to choose.

(d) *Setaria—cotton mixtures (1:1).* At the time of examination, the plants were 60—80 days old. Setaria (*Setaria italica*) plants had finished flowering, had 2—3 tillers per plant and were about 80 cm. in height.

* The time taken for completely eroding bare soil was 33 minutes. Assuming this time to be unity, erosion ratio for the several crops was calculated. For each set, paired samples were taken. The data are presented in the table I appended. These studies were made in 1938–39.

Cotton *(Gossypium herbaceum)* had just started flowering and the plants were 43 cm tall. Under the impact of water, the Setaria plants began to lodge. Gradually the plant cover settled closer to the earth as the hold of the roots was slowly weakened, but the process was slow. The mass of Setaria roots held firmly since the force of water was broken and erosion proceeded slowly. By the end of an hour the soil had been removed to the bottom of the box in only a few of the least protected places. Finally the soil between the rows gave way but the rows themselves held, each as a separate unit, and only after a long time was all the soil eroded. Though the cotton roots constituted a fourth of the weight and volume in the mixture, they were not so efficient in protecting the soil as they were stout and had sparse lateral branches; but the broad leaves of cotton were effective. In Setaria, the innumerable tillers and flowing leaves, combined with thick stand intercept a great deal of the falling water, thus breaking the force of the impact. This action is effectively reinforced by the dense crown roots at stem bases with their well ramified fine branch roots. The time taken for completely washing the soil was 108 minutes, the erosion ratio being 1:3·3.

(e) *Setaria—horsegram mixtures (2 Setaria:1 horsegram).* The Setaria plants were of the same size as those in the above mixture. Horsegram (*Dolichos biflorus*) plants attained a height of 18 cm. In this mixture, the soil was completely eroded in 2 hours and 32 minutes, with an erosion ratio of 1:4·6.

(f) *Setaria—groundnut (spreading) mixtures (1 : 1).* In these mixtures, the groundnut plants had foliage with a lateral spread of 32 cm. The Setaria plants were of the same size as those in the above mixtures. The lodged plants settled down on the spread haulms of groundnut forming such an efficient cover that erosion occurred very slowly. It took 3 hours and 38 minutes for all the soil to wash, the erosion ratio being 1 : 6·6. In this mixture, the efficiency of Setaria as a crop in protecting the soil against erosion, was greatly strengthened by the spread foliage of groundnut.

(g) *Setaria—pure.* The pure crop of Setaria had a very vigorous growth and it took 188 minutes of washing to completely erode the soil, with an erosion ratio of 1 : 5·7.

(h) *Cotton—pure.* The soil was completely washed away in 55 minutes, with an erosion ratio of 1 : 1·6. It will be seen that this is practically no better than bare soil. But in mixtures with Setaria, the erosion ratio rises to 3·3.

(i) *Groundnut (spreading)—pure.* In pure plots with spreading groundnut, all the soil was completely washed away in 164 minutes, with an erosion ratio of 1 : 5·0. In mixtures with Setaria, this ratio rises to 6·6, increasing the efficiency of the mixture. In the pure plots the stand was not so good. In spite of this, the spreading foliage protected the soil for a long time. If the stand were good, it is doubtful if the soil would have been eroded even after hours of washing. The leaflets afforded complete protection to the soil beneath them. The impact of the continuous beating

TABLE I. Relative efficiency of tops and roots of crop mixtures in protecting the soil from erosion.

	Age of plants.	No. of plants.	Height of plants.	Spread of plants.	Number of tillers.	Weight of shoot (dry)	Volume of roots.	Weight of roots (dry)	Erosion time.	Erosion ratio (bare soil = 1).	Remarks.
	days.		cm.	cm.		gm.	cc.	gm.	min.		
Bare soil	—	—	—	—	—	—	—	—	33	—	
Cotton pure	84	12·0	54·0	—	—	110·2	19	8·12	55	1:1·6	Flowering.
Sorghum-groundnut (1:1)											
groundnut (Bunch)	90	11·0	16·0	—	—	66·18	21	3·75 }	63	1:1·9	Pod stage.
sorghum	45	7·0	23·0	—	—	3·81	13	2·15 }			
Sorghum in between groundnut lines: groundnut (Bunch) ...	90	11·0	17·0	—	—	63·32	15	2·87 }	67	1:2·0	Pod stage.
sorghum	45	16·0	21·0	—	—	5·35	15	1·80 }			
Setaria—cotton (1:1)											
setaria	73	7·5	85·0	—	24	30·23	39	11·36 }	108	1:3·3	Flowered.
cotton	73	8·0	43·0	—	—	20·64	10	2·97 }			
Groundnut (Bunch) pure ...	90	18·0	30·0	—	—	106·87	20	4·59	112	1:3·4	Pod stage.
Sorghum—pure	66	9·0	100·0	—	—	216·17	127	31·72	123	1:3·7	Boot stage.
Setaria—horsegram (2:1)											
setaria	63	13·0	60·0	—	28	42·16	39	7·53 }	152	1:4·6	Pre-flowering.
horsegram	63	4·0	18·0	—	—	6·56	8	1·04 }			
Groundnut (spreading) pure ...	50	13·0	—	19	—	29·90	25	3·25	164	1:5·0	Pod stage.
Setaria—pure	83	26·0	84·0	—	38	174·10	66	21·16	188	1:5·7	Dough stage.
Setaria—groundnut (spr.) (1:1)											
setaria	63	7·5	66·0	—	20	35·24	38	7·35 }	218	1:6·6	Pre-flowering.
groundnut (spreading) ...	63	7·5	—	32	—	26·80	18	2·54 }			
Pillipesara (*Phaseolus trilobus*)-pure	—	—	—	—	—	127·95	70	12·75	390	1:11·8	Flowered.

water on the leaflets could be noticed in the etching on the leaf surfaces. Most of the upper epidermis was damaged and chlorophyll in places washed off, giving the leaf a patchy appearance. In spite of this, the soil protected by them was not eroded. Because of the poor stand, water gradually worked through the uncovered portions of the soil and undermined the protected soil.

(j) *Pillipesara–(Phaseolus trilobus) pure:*—The almost complete protection afforded to the soil by a spread plant cover is graphically demonstrated in this crop whose vines and leaves get inextricably tangled and clothe the surface of the soil. As in the case of groundnut, the chlorophyll was scoured from the leaf surfaces in patches by the beating water but the leaves and vines effectively protected the soil beneath them. As a consequence, very little soil was eroded even after six hours of washing, the water percolating through the holes being fairly clear, instead of being muddy. At this stage, the cover was disturbed to hasten the washing. After this, the soil was quickly eroded. The time taken for completely washing the soil was 390 minutes, the erosion ratio being 1 : 11·8. This would have been considerably longer were the plant cover not disturbed (Table I).

These studies reveal that mixtures of sorghum with bunch groundnut are not effective in controlling soil erosion. In fact they are as ineffective as a pure crop of cotton in affording protection to the soil among the crops studied. Mixtures of Setaria and cotton improve the situation slightly. Setaria-horsegram mixtures are considerably better than these. Setaria-groundnut (spreading) combination is the best among the crop mixtures. Pure spreading crops are clearly of advantage. Of the cereals, Setaria with its thick stand, numerous tillers, swaying leaves and panicles and the extensively branched root-system is a very efficient crop in conserving the soil. Though the broad flowing leaves of the single-stalked sorghum intercept and break the force of the falling water their thin stand is ineffective in protecting the soil. A pure crop of cotton protects the soil least. Naturally the loss due to erosion is highest in cotton fields. Sowing strips of cotton alternating with strips of Setaria reduces the severe root competition that exists under the present method of sowing and also helps in the conservation of the soil.

II. Relative efficiency of crops at different stages of growth in protecting the soil from erosion.

As it is common to receive rain at intervals during the growth of the crop in the *mungari* season, a knowledge of the relative efficiency of shoot and root at these stages will give accurate information regarding the damage done to the soil due to erosion were such plant cover not existent and also the protection afforded by the various crops at those stages of growth. The technique adopted was the same as in Section I. Paired samples were taken after each rain. Detailed data are presented in Table II. The respective ages of the crops after each rain together with rainfall data are given below:—

TABLE II Relative efficiency of crops at different stages of growth, against soil erosion.

Plant cover.	Number of plants.	Height of plants. cm.	Spread of plants. cm.	Numbnr of tillers.	Volume of root. cc,	Weight of roots (dry) gm.	Weight of shoot (dry) gm.	Erosion time. min.	Erosion ratio (bare soil=1).	Rainfall received in the interval (inches).	Rainfall received prior to sampling (inches).
Bare Soil.	...	...	...	...	...	...	...	45	...	...	...
Cotton Pure.											
35 days old.	15·0	21·5	...	...	8·0	1·335	14·31	49	1:1·09	2·66	0·54
50 ,,	10·5	28·0	...	...	14·0	3·610	24·66	55	1:1·20	0·43	0·42
68 ,,	16·0	39·5	...	...	26·5	7·160	65·97	83	1;1 84	7·18	2·76
89 ,,	15·0	43·0	...	...	16·0	5·300	54·23	73	1:1·60	0·49	0·33
Setaria Cotton Mixtures.											
35 days old } Setaria.	50·5	15·0	...	1	26·5	2·270	4·74 }	84·5	1:1·90	2·69	0·54
} cotton.	10·0	14·8	...	...	2·5	0·480	3·94 }				
50 ,, } Setaria.	15·0	31·5	...	1—4	26 0	4 430	12·81 }	100	1:2·20	0·43	0·42
} cotton.	8·5	20·0	...	...	7·0	1·750	10·84 }				
67 ,, } Setaria.	20·0	48·0	...	...	17·5	3 160	12·49 }	140	1:3·10	7·18	2·76
} cotton.	10·0	24·0	...	...	9·0	2·580	14·77 }				
87 ,, } Setaria.	14·0	53·0	...	1—2	9·5	2·650	18·09 }	135	1:3·0	0·49	0·33
} cotton.	11·0	31·0	...	...	9·0	2·720	14·89 }				
Setaria Pure.											
30 days old.	62·5	25·5	...	1—2	74·0	8·090	14·01	121·5	1:2·7	2·66	0 54
50 ,,	59·0	50 5	...	1—2	90·0	12·220	42·23	166·0	1:3·7	0 43	0·42
68 ,,	73·0	61 3	...	1—3	57·5	11·290	98·14	197·5	1:4 4	7·18	2·76
88 ,,	92·0	58·0	...	1—2	60·5	13 550	80·98	225·0	1:5·0	0·49	0·33
Groundnut (Spreading) Pure.											
35 days old.	13·5	...	37·5	...	30·0	4·850	42·82	109·5	1:2·4	2·66	0·54
50 ,,	20·5	...	33·0	...	42·5	6·730	55·18	129·0	1:2·9	0·43	0·42
68 ,,	15·0	...	40·0	...	54 0	9·360	109·02	163·5	1:3·6	7·18	2·76
90 ,,	17·0	...	45·0	...	47·5	10·630	169·21	240·0	1:5·3	0·49	0·33

TABLE III.

Age of Plants. (Days)	Rainfall received in the interval. (inches)	Rainfall received prior to sampling. (inches)
35	2·66	0·54
50	0·43	0·42
68	7·18	2·76
89	0·49	0·33
Total.	10·76	

(a) *Cotton pure.* Erosion time and erosion ratio at each stage are given below : –

TABLE IV.

Age of plants. days.	Erosion time. minutes.	Erosion ratio *
35	49	1:1·09
50	55	1:1·20
68	83	1:1 84
89	73	1:1 60

Though with the growth of the plant there is a slight increase in the erosion ratio, it is negligible. This is practically no better than bare soil. Thus at any stage of growth, cotton affords very little protection to the soil against soil loss.

(b) *Setaria – Cotton mixtures* (1:1). Inspite of the reduced growth due to severe root competition, the Setaria-cotton mixtures afford better protection, to the soil than a pure cotton crop. Below are given the erosion time and erosion ratios :—

TABLE V.

Age of plants. days.	Erosion time. (minutes).	Erosion ratio.
35	84·5	1:1·9
50	100·0	1:2·2
67	140·0	1:3·1
57	135·0	1:3·0

The crops in this mixture afford increasing protection with progressive growth in them. This increased efficiency at each stage is not due to the cotton but to the Setaria crop in the mixture. The extensive and dense root system in the soil and the numerous tillers with swaying leaves, break the force of falling water, reducing the soil loss. In the early stages of crop growth, the Setaria roots particularly bind the soil well.

(c) *Setaria—pure.* Because of its earliness, this crop develops and expands its vegetative organs quickly. In the early stages of the crop, the

* These studies were made in 1939–40. The time taken for completely eroding bare soil was 45 minutes. Assuming this time to be unity, erosion ratios have been calculated.

roots are very efficient soil binders, but in later stages the gradually expanding shoot also plays a dominant role The numerous leaves and tillers break the force of falling water and what little water that reaches the ground is further arrested and spread by the closely situated root crowns (as this crop is usually sown thick). The barriers that these rows of root crowns create are such that they remain intact even after all the soil is washed away. From the erosion ratios given below it will be seen that a pure Setaria crop protects the soil efficiently.

TABLE VI.

Age of plants. days.	Erosion time. (minutes).	Erosion ratio.
35	121·5	1:2·7
50	166·0	1:3·7
68	197·5	1:4·4
80	225·0	1:5·0

(d) *Groundnut (spreading) – pure.* Due to the spreading habit the leaflets almost lie on the ground and afford complete protection to the soil. Naturally, as the plant grows and puts on more foliage, its efficiency in protecting the soil increases. The impact of the continuous beating water on the leaves could be noticed in the etching on the leaf surfaces. Most of the upper epidermis was damaged and chlorophyll in places washed off, giving the leaf a patchy appearance. Inspite of its good spread on the ground, small portions of the soil were exposed. Erosion occurred due to the water working through the uncovered portions of the soil and undermining the protected soil. Data showing the increasing efficiency are given below: –

TABLE VII.

Age of plants. days.	Erosion time. (minutes).	Erosion ratio.
35	109·5	1:2·4
50	129·0	1:2·9
68	163·5	1:3·6
90	240·0	1:5·3

Summary. In the 'Black Cotton' soil of the Bellary District, where sheet erosion of the soil has become a serious proposition, it is important to know the erosion resistance efficiency of the several crops and crop-mixtures grown in this tract. A special technique developed by Dr. J. E Weaver of the University of Nebraska, U. S. A., was adopted in these studies. This consists in washing *undisturbed* soil taken out in a wooden frame (40″ × 20″ × 4″) under different plant cover with a steady jet of water delivered in a fine spray simulating rain and noting the relative time taken to erode the soil completely.

From these studies it is clear that spreading crops like Pillipesara (*Phaseolus trilobus*) sown pure or the spreading varieties of groundnut are clearly of very great advantage. The bunch variety of groundnut, though it has a

bushy top, is not efficient as the foliage is at some height from the ground and not spreading over it. Of the cereals, Setaria with its thick stand, numerous tillers and swaying leaves and panicles, is a very efficient crop in conserving the soil. In Setaria an extensively branched and dense root system also contributes a great deal in reducing the soil loss. Sorghum is generally sown thin when raised as a grain crop. Though the broad, swaying leaves intercept and break the force of falling water, the thin stand operates against their efficiency and, consequently, the sorghum crop affords poor protection to the soil. Cotton with its stout tap-root and sparse lateral root system protects the soil least. Naturally the loss due to erosion is highest in cotton fields. It is obvious from these studies that a farmer, who has the interest of his land at heart and who does not want to face the inevitable ruin, should not sow cotton pure in any of his fields. It should be sown along with a soil-binding crop, preferably a spreading one. Since a food crop is to find a place in this mixture, Setaria may meet the situation. But the present mode of sowing this mixture has to be modified since it is not economical. Strip cropping may be done to reduce the severe competition in the root-systems and at the same time protect the soil against erosion. These studies also show that when pure crops which do not afford efficient protection to the soil are grown, a suitable mixed cropping which will be economically, ecologically and agronomically advantageous should be resorted to.

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Soil Erosion and the Coffee Industry.*

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Introduction. I make no apology for addressing you today on the ecological conditions of coffee cultivation in South India, as they afford several interesting points on the management of hill lands under conditions of heavy rainfall; such areas, in fact, on which soil erosion is commonly seen in its most serious and spectacular form.

History of coffee industry. Coffee must be regarded as the oldest of the three main plantation crops in South India, its history as a plantation crop extending back to about 1840. Although many areas planted with coffee have been abandoned or given over to tea, there are considerable areas still producing satisfactory crops, which have been under cultivation for well over half a century. At least one estate in Mysore is known to me

* Paper read at the Twenty-ninth College day and conference of the M. A. S. U. July 1940.

which has been under coffee for a hundred years and which still exists as a productive agricultural unit.

Permanence of plantation crops. This feature of coffee cultivation in South India is perhaps more remarkable than appears at first sight. If we glance at the history of the great tropical 'permanent crops', we find that 'permanent' is perhaps hardly the right term. The coffee industry of Ceylon started and ended within half a century and left the succeeding tea industry with little more than a subsoil over considerable areas of the hills of Ceylon. In Brazil, the coffee industry has been based on the exploitation of fresh lands as the earlier plantations declined. Recent reports indicate that the great coffee industry which has grown up in Colombia in the last thirty or forty years is faced with declining production.

The other perennial crop industries in the wet tropics have hardly had time to show what degree of permanence they possess. The dangers inherent in such forms of agriculture are, however, sufficiently obvious now and there are clear signs of a realization of their importance in agricultural practice. There still remains much to be done, not only in applying conservation methods already known, but in investigating the means of ensuring a stable agriculture in the large areas of evergreen and monsoon forest which have been opened up for the increased production of tropical commodities during the last half century.

System of coffee cultivation and the problem of soil erosion. I believe that the system of coffee cultivation in South India represents one solution of the problem of a stable agriculture under the topographical, pedological and climatic conditions of the coffee growing areas. It is, of course, a particular solution applicable only to coffee (and also to cardamoms) but an examination of one solution may not be without interest in considering the general problem of soil erosion. Further, the solution is only a partial one and there are many ways in which the situation ought to be improved. The fact that the system is one which greatly minimizes soil losses must not be allowed to obscure the existence of danger points which demand special measures.

Although the first essential of an enduring agriculture must be a stable surface soil, protected against the dangers of soil erosion, it is an interesting paradox that the measures, which in a high degree provide this protection for coffee, were not introduced for this purpose at all. The result is that a considerable degree of protection against soil erosion has been incidental and the coffee planter is less alive to the dangers that still exist in certain areas and under certain conditions than he should be.

The system of cultivation in general use in South Indian coffee areas is, shortly, the culture of the crop plant under a continuous shade canopy, composed of a mixture of trees, many of which were constituents of the original plant association which had developed on the area prior to its cultivation. The mode of opening such land varies widely from a complete

clearing of the original jungle and planting shade along with the coffee to the simple undergrowthing and light thinning of the taller trees to permit the development of the young plants. Nowadays, the debris is normally burnt, but in the early days of coffee planting, a number of estates were opened without burning. It is perhaps not without significance that several estates opened in this way in the early days of coffee planting still exist as sound productive units, with no visible signs of serious soil deterioration.

Undergrowth cultivation. The cultural treatment of coffee is normally conditioned by this system of what might be described as undergrowth cultivation. Coffee planters place great store by the preservation of the surface mulch which is built up from the leaf fall from the shade canopy. Soil cultivation with implements is comparatively restricted after the establishment of the young plants, though in this respect there is much variation in estate practice, depending to a considerable degree on the slope of the land.

Shade canopy and soil erosion. Under the shade, the coffee itself is planted closely, very much more closely than is normally the practice in other coffee growing countries, and the ground is covered by the coffee plants from a comparatively early age. From the point of view of soil erosion, this continuous shade canopy affords a very valuable protection against the beating action of the rain on the soil and at the same time reduces the effects of insolation in accelerating organic matter breakdown and reducing the soil's absorptive capacity for water. This protection is, of course, further increased by the continuous cover of the crop itself. Secondly the leaf fall from the shade provides a mulch which is of the utmost value, as has been shown by Lowdermilk in California, in reducing run-off considerably in excess of its absorptive capacity.

Erosion control in mature coffee plantations. In mature coffee therefore, erosion control is achieved to a considerable degree by natural methods—the utilization of a plant association approximating to quite a considerable degree to the natural vegetation of the areas, in which the crop is inserted, as it were. At the same time, it must be repeated that the value of the system has rarely been consciously attributed to its influence on the stability of the surface soil. This has resulted in a complete lack of recognition of the dangers which can arise from a failure to take additional precautionary measures under certain circumstances.

Erosion losses in young plantations. The main dangers arise in the early stages of opening land under coffee or in replanting old lands with new plants, and in the laying down of drainage which is frequently necessary. Under these conditions, the coffee industry has been slow to undertake conservation measures from a lack of understanding of the damage that can occur in a very short period of time.

Work in East Africa showed that in a coffee clearing on a slope of one in six and under a rainfall of between 60 and 80 inches without any control

measures, the loss of soil amounted to 38 tons in two years or about 2¼ per cent of the top foot of the soil. There is no reason to believe that losses of the same order do not occur in South India in newly opened land as the shade affords small protection at this stage and the rainfall and slopes often exceed those experienced in the experiment in question.

Erosion control measures rare in S. India. It is rare to see any measures for erosion control in coffee clearing in this country; planting and working is carried out up and down the slope, felled trees lie across the contours, cover crops are very rarely seen and only very recently has any interest been aroused in the use of green manure plant hedges. In only one district, where slopes are exceptionally steep, are any attempts at terracing common. Even the use of green manure hedges cannot be regarded as introduced as a measure of erosion control, since the emphasis is mainly on the provision of organic matter and of temporary shade. Contour ridging or box ridging such as is practised in East Africa is quite unknown.

Effects of erosion control measures are not spectacular. It is clear that much can be done in reducing the losses which undoubtedly occur in the early years of opening up coffee or when old areas are replanted. The great difficulty lies in convincing the planter of the damage that is taking place. The effects of erosion control may not be obvious nor the economic gains considerable. The results in the experiment quoted above are of interest in this respect. Where the erosion control measures depended on growing green manure hedges on contour bunds or on the provision of a cover crop, the check to soil losses was very great but the condition of the coffee in the dry season following the rains was noticeably better in the controls. This was traced to a lower percentage of soil moisture in the plots carrying the supplementary crops. To many planters, the immediate differences would bulk very much larger than prospective gains resulting from the soil retention, which could only be cashed in over a long period of years. Even where the control measures would not involve soil moisture competition, it is unlikely that any striking differences in growth and development would be visible for some considerable time and the cost factor would discourage a practice the value of which is not readily demonstrable. Herein lies the great problem of erosion control. In its spectacular manifestations, the damage done is obvious and calamitous. The spectacular manifestation is, however, the end product of a long series of invisible movements, the control of which means trouble and expenditure without any apparent return. The return comes in time in the maintenance of productivity and of the capital value of the land but unless the cultivation methods are very wasteful the differences may take a long time to show themselves.

Soil erosion not serious in South Indian coffee plantations. The situation is especially difficult in coffee, where with growth of the shade cover and the development of a litter of fallen leaf, the early losses are

checked and the damage done greatly slowed down. At the same time, the efficiency of the litter cover must be regarded as having been reduced by the damage done in the few years of exposure in the early stages of opening the land. At the same time, it must be pointed out that it is not easy to point to coffee areas in South India where a reasonable shade policy has been followed, which show serious signs of deterioration from soil erosion. Individual cases may occur on small areas where special circumstances play a part but speaking generally, I think it would be agreed by those familiar with South Indian coffee areas, that soil erosion plays a small part in determining the productivity of the land under this crop.

Conclusion. In conclusion, therefore, it may be said that the system followed on most coffee areas in South India affords a substantial degree of protection against soil erosion. There seems no great need for elaborate measures for its control and on the whole, it seems that attention to the improvement of control by the use of vegetation will meet most of the needs of coffee cultivation. This requires most emphasis in connection with the opening up of land for coffee or the replanting of old land. Most of all, planters require education on the question of soil erosion so that special cases can receive prompt attention and that cultivation methods, especially trenching and draining, shall be carried out with the dangers of badly designed work in mind. There is no question that much can be done in opening new clearings by the effective disposal of debris along contours, carrying out weeding and other works along contours and by raising green manure crops at a very small cost to check the losses during the years before the shade and its litter become effective.

Some Correlations in the Appendages of the Indian Honey Bee.

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Introduction. That variations in honey bees are displayed not only in the average dimensions of their various appendages, but in the coefficients of correlations between such measurements as well, was indicated by Alpatov (1929). In the present paper are furnished the coefficients of correlation of the measurements of tongue, right forewing and right hind leg of four colonies of *Apis indica*, the variations in the biometry of which were reported previously (Ratnam, 1939). The data used for the present paper are the same as those used for the previous one.

Material and Method. The data relate to four colonies of *Apis indica*, which differed in the number of supers each had and in their honey storing abilities. About 50 nectar gathering bees from each hive were collected separately within a period of six days and killed immediately in cyanide bottles. They were numbered serially noting also the number of hive from which each bee was collected. Wings and leg were removed immediately

and kept mounted on separate slides and labelled properly. The heads of the bees were macerated in a five percent solution of potassium hydroxide as described by Alpatov (1929). The tongues were then dissected and kept mounted in glycerine jelly, the slides being labelled properly.

The slides for the right forewing, right hind leg and tongue pertaining to each individual bee were handled together. The following measurements were recorded from these slides : (1) lengths of submentum, mentum and ligula each separately ; (2) the proximal and distal length of the right forewing measured separately ; (3) the breadth of the right forewing ; (4) lengths of femur, tibia and metatarsus taken separately ; and (5) the breadth of metatarsus. For purposes of measuring, a Leitz micrometer eyepiece calibrated previously with an object micrometer was used. Initially all measurements were noted in terms of the number of divisions in the micrometer eyepiece. For purposes of computing all correlation coefficients, the metric measurements were not used, but frequencies were tabulated as per the micrometer eyepiece readings only, since the unit of measurement adopted in all cases is identical. The figures presented in Table II below were first arrived at in terms of micrometer readings, and then converted into millimetres.

Appendages. In Table I, the correlations of the lengths of any two of the three appendages, namely tongue, right forewing and right hind leg are presented. It will be seen that the tongue length is not correlated to either the wing length or the leg length. To this extent the observations of Grout (1937) who obtained a significant positive correlation between tongue length and wing length in the European bee does not obtain confirmation in the present study. In the case of leg length, significant positive correlations have been noticed in all the hives except hive IV, and these correlations do not also differ significantly.

TABLE I. Appendages.

Correlation between	Hive No. I	Hive No. II	Hive No. III	Hive No. IV
1. Tongue length and length of right forewing.	0·0602 (43)	0·0632 (45)	0·1631 ± 0·1126 (34)	−0·2396 ± 0·0959 (44)
2. Tongue length and length of right hind leg.	0·1774 ± 0·0974 (45)	0·1420 ± 0·1007 (43)	0·1895 ± 0·1054 (38)	0·0708 (48)
3 Length of right hind leg and length of right forewing.	0·4170 ± 0·0893 (39)	0·5495 ± 0·0778 (41)	0·5581 ± 0·1105 (47)	0·2160 ± 0·0967 (44)

Note :—1. The numbers within brackets indicate the number of pairs of observations (n) from which the correlations have been computed.

2. The correlations underlined are highly significant. The others are not significant.

In Table II the calculated length of right hind leg for a given length of right forewing in the case of hives I to III respectively is furnished for the sake of comparison. These have been computed by the use of the usual regression formula. It is observed that the bees of hive III possess relatively longer legs as compared with those of the other hives. These observations further confirm the previous findings (Ratnam, 1939) wherein judging from the mean leg lengths alone it was stated that the bees of hive III have long legs.

TABLE II. Calculated length of right hind leg for a given length of right forewing (in millimetres).

Wing length.	Leg length		
	Hive No. I	Hive No. II	Hive No. III
7·301	5·490	5·855	6·037
7·371	5·714	6·009	6·220
7·441	5·939	6·150	6·402
7·511	6·164	6·304	6·571
7·582	6·388	6·458	6·753

The Tongue and its parts. In Table III are furnished the coefficients of correlation of the tongue and its parts for the four hives under study. The existence of a very high positive correlation amounting to over 0·9 between the length of ligula and the total tongue length in all the hives indicates that the ligula almost solely contributes to the length of the tongue. Grout (1937) observed in the European bee that the length of proboscis correlates significantly with its integral parts. In the present study, however, the submentum does not correlate at all with the total tongue length while mentum correlates significantly with the tongue length only in the case of hive I. Whether this correlation is merely spurious or whether it should be taken as indicative of an inherent variation in this colony, it is not possible to conclude definitely with the available data, and further work would be necessary. Ligula length is not correlated either with the length of the mentum or of submentum, nor is there any correlation between the latter parts. In a previous communication (Ratnam, 1939) it was pointed out that the mean aggregate length of submentum plus mentum in the four hives showed less variations despite the existence of remarkable variations in the mean lengths of each one of these parts and a conclusion was attempted to be drawn that the bees from those hives having short mentum have relatively long submentum and *vice versa*. The present study indicates that as between the length of submentum and of mentum of each bee no significant correlation exists in any of the hives showing that these dimensions are independant of each other. This perhaps points to the fact that the occurrence of short submentum coupled with a long submentum or *vice versa* noticed in particular hives is a case of inherent variation. A further study with a larger number of hives would alone confirm this observation.

TABLE III. Tongue and its parts.

Correlation between	Hive No. I	Hive No. II	Hive No. III	Hive No. IV
No. of pairs of readings	50	49	50	49
1. Total tongue length and length of				
(a) Submentum	0·1886 ± 0·0921	0·1868 ± 0·0914	−0·1248 ± 0·0939	0·0626
(b) Mentum	0·5265 ± 0·0690	0·2106 ± 0·0921	0·0198	—
(c) Ligula	0·9604 ± 0·0074	0·9781 ± 0·0041	0·9190 + 0·0146	0·9647 + 0·0067
(d) Submentum plus mentum	0·5195 ± 0·0697	*0·3228 + 0·0863	−0·1448 + 0·0934	−0·0102
2. Length of ligula and length of				
(a) Submentum	0·2199 ± 0·0908	0·0684	−0·2100 ± 0·0888	0·0807
(b) Mentum	0·2480 ± 0·0891	0·2128 + 0·0920	−0·0741	0·0820
3. Length of mentum and length of submentum	0·1147 ± 0·0942	0·1398 + 0·0945	−0·1303 + 0·0938	−0·2577 + 0·0900

Note:— The correlations underlined are highly significant, while those marked with * are significant only at the 5% level. The others are not significant.

TABLE IV. Wing and its parts.

Correlation between	Hive No. I	Hive No. II	Hive No. III	Hive No. IV
No. of pairs of readings	43	45	34	45
1. Length and breadth of right forewing.	0·0142 ± 0·0747	0·5070 ± 0·0757	0·5032 ± 0·0864	0·3804 ± 0·0860
2. Proximal length and distal length	0·2251 ± 0·0971	0·2847 ± 0·0924	*0·3569 ± 0·1009	0·2071 ± 0·0962
3. Proximal length and breadth	0·2795 ± 0·0948	*0·3250 ± 0·0899	0·4822 ± 0·0888	*0·2998 ± 0·0915

Note:—The correlations underlined are highly significant, while those marked with * are significant only at the 5% level. The others are not significant.

Wing and its parts. Alpatov (1929) has arrived at a correlation of 0·593 between the length and width of the right forewing. This is comparable with the highly significant positive correlation amounting to 0·5142, 0·5070, 0·5032 and 0·3804 observed in the present study in the case of the four hives (vide Table IV). The last mentioned correlation does not differ significantly from the others. The proximal and distal lengths of wing do not appear to be correlated and the correlation coefficient of 0·3569 obtained for hive III which is significant only at the 5% level cannot be taken as fully indicative of the existence of any special variation in this hive till further confirmation is available. Further, this hive gives a highly significant positive correlation between the proximal length and breadth of the wing. Hives II and IV have furnished correlation between

the lengths of these parts which are significant only at the 5% level. Further studies may be necessary to conclude if the proximal length of the wing is at all correlated to its breadth and if hive III is a case where exists a variation from the others in respect of this relationship.

The Leg and its parts. The correlation of the dimensions of the leg and its parts namely, femur, tibia and metatarsus are presented in Table V. The lengths of these parts generally exhibit a significant positive correlation to the total length of the leg, and it therefore appears that every one of these parts individually and severally contribute to the relative shortness or otherwise of the leg. Nevertheless as between these parts, the existence or otherwise of a correlation does not seem to be consistent. For instance the length of femur is correlated to the length of metatarsus only in the case of hives I and III while the tibia length is correlated to that of metatarsus only in hive I. The data appear to be too meagre for spotting out any special variation in any colony or for generalising on the existence of relationships between the lengths of these parts.

TABLE V. Leg and its parts.

Correlation between	Hive No. I	Hive No. II	Hive No. III	Hive No. IV
No. of pairs of readings	45	43	41	49
1. Total length of leg and length of				
(a) Femur	0·6519± 0·0578	0·5109± 0·0760	0·5355± 0·0751	*0·3518± 0·0844
(b) Tibia	0·8341± 0·0306	0·7920± 0·0383	0·6317± 0·0631	0·8119± 0·0328
(c) Metatarsus	0·7811± 0·0392	0·7358± 0·0472	0·7049± 0·0530	*0·3458± 0·0848
2. Length of femur and length of				
(a) Tibia	0·1811± 0·0973	0·0450	−0·2050± 0·1009	0·2776± 0·0889
(b) Metatarsus	0·4384± 0·0813	0·2319± 0·0974	0·7696± 0·0430	0·1452± 0·0943
3. Length of tibia and length of metatarsus	0·5641± 0·0686	*0·3413± 0·0909	0·1592± 0·1027	—
4. Breadth of metatarsus and length of				
(a) Femur	*0·3318± 0·0895	0·0135	0·1930± 0·1014	0·1573± 0·0940
(b) Tibia	0·5755± 0·0673	0·1548± 0·1004	0·2084± 0·1008	0·2027± 0·0924
(c) Metatarsus	0·0594	0·2565± 0·0961	0·0335	0·3784± 0·0826
(d) Total leg length	0·2282± 0·0938	0·1334± 0·1011	*0·3545± 0·0921	0·8778± 0·0221

Note:—The correlations underlined are highly significant, while those marked with * are significant only at the 5% level. The others are not significant.

Discussion. Correlation is not "the key to all the secrets of nature. In reality its utility as a statistical method is narrowly limited. The correlation coefficient measures association accurately only when the relation is linear. If non-significant correlations occur in the course of an investigation, interpretations should be made only tentatively". These words of Snedecor (1938) are as true for the present study on the Indian Honey Bee about which so little is known, as they are for any other biological investigation.

The scope of the present paper is indeed very limited. The data under consideration are admittedly too meagre to justify the drawing up of any general conclusions. The correlations obtained perhaps serve more as an indicator to what may be the expected trends and are to some extent different from those obtained by previous workers on the European bee.

The usefulness of correlation coefficients rests not only in spotting out variations as between colony and colony, but also in serving to conclude as to which particular appendages of the bee could be most efficiently used for biometric studies. The utility of the coefficients ultimately rests in their contributing to the isolation of useful races of bees. Our knowledge of such correlations is at present very meagre, and a carefully planned detailed study of the characteristics of bees available in different localities seems to be urgently necessary.

Summary and Conclusions. Some of the correlations in the dimensions of tongue, right forewing and right hind leg determined in four colonies of *Apis indica* are presented in this paper. The data considered are admittedly rather meagre for drawing any general conclusions. Significant positive correlations have been noticed between leg-length and wing-length, but no such correlations have been noticed between tongue-length and wing-length or between leg-length and tongue-length. The length and breadth of wing are highly correlated positively and so also the total length of leg and that of its integral parts. Again the tongue length is also correlated highly with the length of ligula. It is concluded that further work would be necessary to draw general conclusions.

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Sorghum, Spikelet—Awn Relationships and Inheritance

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The classification of sorghum is based primarily on the characters of the sessile spikelets, because they are less likely to have been modified in the evolution of the various cultivated species from their wild ancestors. The spikelets of sorghum may be awned or awnless. The awn is prominent in wild sorghum, in which it can be as long as 40 mm. In cultivated sorghum, however, the awn is much shorter, the longest being about 15 mm. Most of the wild sorghums possess awns; in the cultivated races both awned and awnless conditions prevail. The presence or absence of awn and the gradations in its length when present, are governed by genic factors. Given the full compliment of factors determining maximum expression of length, it can be said in general terms, the bigger the spikelet the longer the awn tends to be. Among the wild sorghums that have so far been examined at the Millets Breeding Station, Coimbatore, this relationship was borne out.

Wild sorghums

Species.	Size of flowering spikelets in mm.	Awn length in mm.
Sorghum sudanense, Stapf	5·0 × 2·5	7 – 9
S. arundinaceum, Stapf	6·0 × 2·5	9 – 11
S. virgatum, Stapf	6·0 × 2·5	11 – 13
S. versicolor, J. N. Anderss	6·5 × 2·5	30 – 35
S. dimidiatum, Stapf	7·0 × 2·5	32 – 37
S. purpureo-sericeum, Aschers et Schw	8·0 × 3·0	35 – 40

Among the cultivated races of sorghum, owing to constant inter-crossing and continued selection, this relation between the spikelet size and awn length was disturbed with the result that in the highly developed grain sorghum groups, numerous blends of spikelet-awn length combinations are met with. This disturbance was least in *S. coriceeum*, Snowden, an African group with markedly coriaceous glumes and prominent awns, in which the relationship is maintained.

***Sorghum coriaceum*, Snowden.**

Selection No.	Name of variety.	Place.	Size of spikelets mm.	Length of awn	
				Average mm.	Range mm.
A. S. 4165	Nsonte	N. Rhodesia	8·0 × 4·5	14	13 – 15
,, 4203	Plot 69/1931 Masabuka Experiment Station	,,	6·0 × 4·0	12	11 – 13
,, 4149	Munkokwe	,,	6·0 × 4·0	11	10 – 12
,, 3445	Zibaiba	,,	5·5 × 3·5	10	9 – 11
,, 4132	Luano	,,	5·5 × 3·5	10	9 – 11
,, 4135	Masaka Luwemba	,,	5·5 × 3·5	10	9 – 11
,, 4160	Shamba	,,	5·0 × 3·0	8	7 – 9
,, 4161	Chibolwe	,,	5·0 × 3·0	8	7 – 9

Describing the *S. coriaceum* group Snowden says, " Little is known as to its origin, but the strongly coriaceous glumes and the frequent occurrence of long strong awns suggest that it may have arisen through the inter-crossing of indigenous wild species with a cultivated race such as *S. caffrorum*, Beauv." (Snowden, J. D., 1936. The Cultivated Races of Sorghum ", Pp. 126 – 27) Hence it is probable that *S. coriaceum* by virtue of its closer affinity to wild sorghums, is showing this ancient *spikelet-awn* trend graphically.

The size of the well developed flowering spikelets within a pure breeding line and within a panicle is constant, there being practically no variation. The length of the awn is fairly constant within a pure breeding line. Within a panicle there is a small variation in the length, those towards the top of the panicle tending to be a little longer than those below. This varies from 0·5 mm. to 2·55 mm. in cultivated sorghum and up to 5·0 mm. in the wild ones, depending upon the length of the awn, the longer awns showing greater variation. The awns at about the middle of the panicle may be taken to represent roughly the average length.

A. S. 4163 is a selection of *S. caffrorum*, Beauv. from North Rhodesia, Africa. This has ovate spikelets measuring 4·0 × 3·0 mm. with awns 4 mm. in length. In this family a natural cross with spikelets ovate in shape measuring 4·5 × 3·2 mm. with awns 6 mm. long was noted. The characters of this F_1. and the behaviour of the progeny in the F_2. and subsequent generations indicated that the pollen parent must have belonged to the group *S. coriaceum*, Snowden. This selection segregated in the F_2. generation for spikelet shape and size and awn length. The following are the character pairs that segregated.

Character.		Dominant.		Recessive.
Spikelet shape		Ovate		Elliptic
Spikelet size	Length	4·5 mm.	Length	7·0 mm.
	Breadth	3·2 mm.	Breadth	4·5 mm.
	{ Range L. 4·0 to 5·0 mm. }			
	{ „ B. 3·0 to 3·5 mm. }			
Awn length		6·0 mm.		11·0 mm.
	(Range L. 4·0 to 8·0 mm.)			

The character group ovate, smaller spikelets and shorter awns went together. The bigger elliptic spikelets with longer awns also went together. The segregration was for these two groups, viz., 81 of the former and 31 of the latter. From this segregating family, 10 selections consisting of 7 with small ovate spikelets and short awns and 3 with large elliptic spikelets and long awns were carried forward and an F_3. generation raised. Of the 7 selections with short ovate glumes and short awns, 3 bred pure and 4 segregated again giving a total of 303 plants with small ovate spikelets with short awns and 99 plants with bigger elliptic spikelets with long awns. The 3 large elliptic spikelet selections with long awns bred pure. There was the inevitable accentuated fluctuation and the consequent wider range in the size of spikelets and length of awns in the dominant group, especially with a 2/3 heterozygous population.

Concurrent with the segregation for spikelet size, the stigma and anther sizes also varied. The smaller spikelets had smaller stigmas (4 0 mm.) and smaller anthers (2·5 mm.) and the bigger spikelets had bigger stigmas (6·0 mm) and bigger anthers (3·5 mm). Even the size of the lodicules responded likewise.

Summary. In sorghum it could be stated in general terms that awns, when present (in whatever strength of expression) increase in length and keep pace roughly to spikelet size. In Mendelian segregations small ovate glumes with short awns have proved a monogenic dominant to big elliptic spikelets with long awns. The stigma, anther and lodicules kept pace with spikelet size.

SELECTED ARTICLE

Nutrition and Agriculture.

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If human beings are to be properly nourished they must have enough food to eat and the right kind of food to eat. In India we are faced with the problems of obtaining enough food for the people and the right kind of food. The former takes precedence over the latter. A considerable part of the population is under-fed in the quantitative sense—as the nutrition workers say, food intake falls short of calorie requirements. What proportion lacks sufficient food we do not exactly know, but recent dietary investigations suggest that it is no small one. In some parts of the country the danger of famine is always imminent.

Enough Food. It follows that the *principal* aim of agriculture must be to increase production of *all kinds of food.* It is essential, as we shall see, that the quality of diets should be improved, but in attempting to achieve something in this direction we should never lose sight of the primary need for more food. At present this must be produced in the country itself, because India cannot afford to import food in large quantities. All activities which will increase food production are therefore of the utmost importance. The development of fisheries, the extension of irrigation, the use of efficient manuring methods, the introduction of improved or high-yielding strains of common food crops—all come under this head. The value of the last may be particularly emphasized. Improved strains may give a yield from 10 to 30 times in excess of those they replace in the Madras presidency in 1937, 1·78 million acres were under improved varieties of rice, representing about 18 per cent of the total area under rice ; while in the Punjab 4·26 million acres were sown with similar varieties of wheat, which amounts to nearly half the total acreage under wheat in that province. This represents an achievement on which agricultural research institutes and departments are to be congratulated.

One of the advantages of increasing the production per acre of staple food grains is that it releases land for the production of other kinds of food. India is a densely populated country, and at present most of the good land must be used to grow cereal crops. Otherwise there would not be enough food to go round. Land so cultivated gives a higher return of solid food than land used, let us say, for producing fruit, vegetables or milk.

The right kind of food. The chief defect of Indian diets, on the qualitative side, is that they contain too much grain and too little else. Diets of this kind

are "un-balanced" because of the preponderance of cereals. Sir Robert McCarrison, in his little book *Food** describes a balanced diet as follows : –

> The right kind of food for Indian children and, indeed, for children in any country is one made up of the following, simple things:—(1) any whole cereal grain or mixture of cereal grains; (2) plenty of milk and the products of milk—curds, buttermilk, butter, ghee; (3) sprouted pulses; (4) eggs or liver, or meat, or fish, occasionally, if religion permits their use; (5) tuber and root vegetables; (6) abundance of green leafy vegetables and (7) fruit. These are the things with which the appetite should be satisfied; the things that should be eaten for health's sake. What else is eaten does not greatly matter so long as it is simple, clean, easily digestible, well prepared and not in excess of the body's needs.

Diet Surveys. We have today a good deal of knowledge about the kind of diet which people eat in many parts of India. This has been obtained by what are called *diet surveys*. If you ask a man what kind of diet he eats he will tell you vaguely that he sometimes eats this and sometimes that and even after careful questioning you will remain in doubt as to what his diet really consists of. He may want to show how well he feeds or perhaps the opposite, and in either case he will make exaggerated statements. In a diet survey a trained investigator visits families twice daily for a number of weeks and weighs all the foods which they are going to eat so that exact data are obtained. It is sometimes hard to persuade poor families to cooperate in such investigation; they are naturally suspicious of the motives of the investigator. But this difficulty can be over come by tact and patience. The result of diet surveys of this nature has been to provide a clear picture of Indian dietary habits, and one of the points which has been demonstrated is the insufficient intake of foods other than cereals. The average Indian diet contains too little milk, pulses, vegetables, fats of various kind, and fruits. It does not approach the kind of diet which Sir Robert McCarrison recommends.

The cereals. The cereals, which include wheat, rice, the various millets, barley, rye, oats and maize are as a group approximately similar in food value. They do not contain a sufficiency of various food constituents, including vitamins which are needed by human beings. The rice grain is designed by nature to feed the rice germ or embryo, and no doubt it is well adapted for this purpose. But it is not well adapted to fulfil human food requirements in every respect. Still less is it suited to this end when it has been milled. The outer layers of cereal grains are richer in various nutritive materials than the starchy inner part or endosperm. Milling removes the outer layers and leaves the grain impoverished. In India it is the chief food crop—rice which suffers most by milling, rice being a grain which is particularly easy to mill. Wheat as a rule is eaten "whole" in the form of *atta*—a very healthy habit. The various millets which follow rice and wheat in order of importance are not usually milled. The grains are so small that removal of the outer layers would be difficult.

Supplementary Foods. But whatever the state in which cereals are eaten, a sufficient intake of other foods is essential. Nutrition research workers have studied the value of the various supplementary foods consumed in India and have gained a very fair idea how much of each is desirable and how far typical Indian diets fail to contain the desirable amounts. We are therefore in a position to suggest, the broad lines which agricultural policy should follow in order to improve the quality and balance of Indian diets. A greater intake of milk and milk products, eggs, fish, pulses, vegetables and fruit, is particularly necessary. Every attempt should therefore be made to encourage the production of these foods.

* Published by Macmillan and Co., Ltd., Madras.

A considerable amount of detailed knowledge about food value, etc. is available to guide food production in the right direction. A few examples may be given; all kinds of milk—including cow's, buffalo's, and goat's milk—are of high nutritive value, as is the evaporated milk product of North India (*Khoa*) which is largely used in making sweets. Skimmed or separated milk is very good food. Most of the pulses are roughly similar in nutritive value, so that it does not much matter which variety is encouraged. The soya bean has in the past been considered an exceptionally valuable food which should be made popular in India. Experiments have however shown that it is no better than many other common pulses and there is not much point in spending a great deal of time and money in increasing its cultivation. Among the vegetables, the green leafy kind is particularly rich in vitamins and other necessary food constituents. The food value of most fruits grown in India has been investigated and the results are available. These show, for example, that two kinds of fruits the cultivation of which is spreading—the tomato and the orange are rich in certain vitamins and are worth further encouragements. There are fish available in Indian waters which can provide liver oil richer in vitamin A than cod liver oil and the development of fisheries might allow local industries for the production of such liver oils to be established. Many other examples of useful data about food values might be given.

Sugar. Within comparatively recent times the peoples of Europe and America have begun consuming sugar in large quantities. This habit has been made possible by the large-scale development of sugarcane production in the tropics and beet production in Europe. The only concentrated form of sugar known in European antiquity was honey, a relatively rare and costly product, for bees, however industrious, cannot rival sugar factories in their output. In India sugar has been manufactured from cane for many centuries. The sugarcane originated in the Ganges basin and it is said that about the year A. D 648 the Chinese Government sent officials to India to study its cultivation and methods of extracting the juice. In the last few years the sugar industry has shown rapid development in its original home as the result of protection and imports of sugar have fallen. *Per capita* consumption of sugar in India is however, small in comparison with consumption in Europe and America.

An increase in the supply of sugar in India is all to the good; as has been said any increase in total food production is of the utmost importance. But it must be remembered that sugar whether refined or unrefined, is a food of limited value. While it is a concentrated source of food energy, it contains no protein or vitamins and an increased intake of sugar will not help to balance Indian diets. In England nutrition experts have objected to the Government subsidy to the beet sugar industry on the ground that the money might have been better spent in improving the supply of milk or other highly nutritious foods.

Cash crops. Another subject about which nutrition workers have something to say is that of cash crops. It is of course desirable that the production of valuable non-food crops, such as cotton, tobacco, etc. should be encouraged up to a certain point. The wealth of the country is thereby increased. But there may be danger in paying too much attention to cash crops at the expense of food crops. Prices fluctuate according to the level of world markets and an area in which the cultivation of a paying crop has been taken up with enthusiasm may experience a disastrous slump. When this occurs the population suffers because it is no longer producing food for its own use. The recent report *Nutrition in the Colonial Empire* published by the Economic Advisory Council* contains a

* Committee on nutrition in the Colonial Empire, First Report. Parts I and II, 1939.

good deal about this question which is probably more urgent and important in Africa and the West Indies than in India.

The report sums up the position as follows :—

"The aim should be the establishment of a *balanced agriculture* for the production of commodities produced to be used either for direct consumption by the producer and his family or for sale for consumption elsewhere in the country or for sale in overseas markets. As regards commodities produced for export it appears that the producer must continue to expect wide variation in his income from money crops. Family production of foods to meet family needs is a great safeguard against some of the worst social and economic effects of fluctuations in the income from money crops."

In the southern United States a serious food deficiency disease called *pellagra* is prevalent. This is usually caused by a diet which contains too much maize and too little else. Maize is a dangerous food for very poor people and this fact should be remembered should there be signs of its becoming an important crop in India. The southern United States are a great cotton-producing area, and the small farmer may devote his land almost exclusively to cotton and buy his food, chiefly maize, in the local market. When the price of cotton slumped in the bad years around 1930—33, the incidence of pellagra did not rise ; rather it tended to fall. The reason for this was that the farmer, instead of growing cotton which no longer paid, began to produce vegetables and other foods for his own use. Though he had less money in his pocket, he was actually better fed.

This example illustrates the disadvantages of relying too much on a single crop. It can also be used to illustrate the advantages of growing vegetables for home consumption. In many parts of India much more vegetables could be grown in the village, if people would take the trouble to do so. Every house should have a little vegetable garden, or else vegetables should be grown on some suitable piece of ground near a well or wherever water is available. Waste water from the house can be used to water vegetables. It is surprising what a large amount can be raised from a small plot.

Farming and Diet. The improvement of farming and the improvement of diet are so closely inter-related as to be almost the same problem. An increase in the production of certain kinds of food may create new habits of diet. Thus, the consumption in England of tropical and sub-tropical fruits, such as bananas and oranges has risen enormously during the last 30 years, because of their cheapness and availability which followed the development of fruit farming in the West Indies and elsewhere. In India the increasing supply of excellent home-grown oranges is visibly creating a taste for this fruit. Conversely, a demand for certain kinds of food which can be stimulated by educating the people about nutrition, may influence agricultural production. For example in America the insistence of nutrition experts on the value of milk and milk products has raised national milk consumption and brought prosperity to certain states largely occupied in the dairy industry. An interesting review of such questions will be found in the League of Nations report, *The Relation of Nutrition to Health, Agriculture and Economic Policy*.* This report shows how agriculture in Europe has been able to adapt itself to a change in food habits in the direction of more dairy products, vegetables and fruit—i. e. a change for the better. We may hope that in time Indian agriculture will be able to make the adaptations which are necessary to improve the nutrition of the people.—*Indian Farming.*

* Final Report of the mixed committee 1937.

ABSTRACTS

The Copper content of Long Island soils in relation to tuber-rot of potatoes caused by Phytophthora infestans: (Mont. de Bary), J. B. Skaptason, L. C. Peterson and F. M. Blodgett. *Amer. Pot. Jour.* 17 : 88—92.

Tuber rot of potatoes was found to be very negligible in spite of abundant and continued supply of sporangia introduced into the soil by very severe infection of foliage and dying of plants. To determine whether copper in the soil due to continued spraying with Bordeaux mixture over a period of years might be a factor, germination of sporangia of *P. infestans* was tested in water in which these soils were suspended. The soils were also analysed for copper content. Bordeaux mixture of different strengths from 2—1—50 to 8—4—50 were tried on foliage and the average number of blight lesions decreased with the increase of the strength of Bordeaux mixture. All the plants died in the check plots but there was no tuber-rot in any of the plots. Ten fields (9 of 'old' soils and one of 'virgin' soil) were analysed for total copper. The old soils have been used to potato for periods ranging from 18 to 32 years. The copper content of these fields varied from 69·6 to 90·5 parts per million of metallic copper. The 'virgin' soil was found to have rather a high content of copper probably due to water run-off from adjacent fields. Germination tests of sporangia were tried on a film of water surrounding virgin soil and soil used to potato for 32 years. Germination was 8·6 per cent in 'old' soil and 50·4 per cent in 'virgin' soil as against 65·4 per cent in distilled water. C. R. V.

Tobacco Seed-bed Fertilizer Experiments. L. F. Mandelson *Queensland Agr. Jou.* 53: 516—525 (1940).

The physiological trouble known locally in Queensland as 'yellow patch' of tobacco seed beds was found to be associated with the use of large quantities of organic nitrogen such as dried blood or animal manures and was probably caused by the accumulation of free nitrogen in the soil coming in contact with the roots of young tobacco seedlings. *(Queensland Agr. Jou.* Sept. 1939). To avoid this trouble tobacco growers were advised to use only nitrate of soda as a source of nitrogen in mixed fertilizers for seed beds. Two seed bed fertilizer experiments were conducted in 1939-40 season with a view to control 'yellow patch' and to obtain satisfactory seedling growth. They were designed to investigate the effect of (1) nitrate of soda applied at the rates of ½ oz., and 4 oz., per sq. yard. (2) superphosphate applied at the rates of 0 oz., 1 oz., 2 oz., and 3 oz., per sq yard. and (3) sulphate of potash applied at the rates of 0 oz., ¼ oz., ½ oz. and ¾ oz., per sq. yard. The treatments were arranged in randomised blocks of sixteen plots, certain of the higher order interactions being partially confounded. Each plot was 1 sq. yard in area. Observations on growth of seedlings, plant population per plot and root development of seedlings were recorded One of the experiments was a partial failure due to nematode infestation. All the data were statistically analysed, and the following conclusions were arrived at. (1) A significant increase in growth resulted from the application of 4 oz.. of nitrate of soda per sq. yard in both experiments. (2) Superphosphate at the rate of 2 oz. per sq. yard in the first experiment and at the rate of 3 oz. per sq. yard in the second experiment resulted in optimum growth responses. When applied at the rate of 2 oz. per sq. yard, in the second experiment superphosphate significantly increased both seedling root development and plant population per unit area and neither nitrogen nor potash had any such effect. (3) Sulphate of potash, did not significantly enhance seedling growth in either experiment. When applied

in relatively heavy doses, associated with relatively heavy applications of superphosphate it had a depressing effect on growth.

Based on the above conclusions, a seed bed fertilizer mixture is recommended by the author. It consists of 48 percent nitrate of soda, 10 percent cotton seed meal (to supply bulk), 32 percent superphosphate, 3 percent sulphate of potash and 7 percent magnesium sulphate. When this is applied at the rate of $5\frac{1}{4}$ lb. per 100 sq. ft. it supplies the equivalent of 4 oz. of nitrate of soda $2\frac{1}{4}$ oz. of superphosphate and $\frac{1}{4}$ oz. sulphate of potash to each square yard of seed bed.— T. N.

Farmyard manure. *Trop. Agriculturist*, 94:257—261.

Farmyard manure is a mixture of the litter and solid and liquid excreta of farm animals, which may have undergone a certain degree of fermentation, and would supply the soil with all the essential elements, viz., nitrogen, phosphorus and potash; and in addition activates the soil's bilogical and chemical processes, thus increasing the availability of other essential elements. The agricultural value of any sample of manure depends primarily upon its composition; this composition, is largely determined not only by the relative proportions of solid and liquid excreta and litter, but upon such factors as the kind, age, food and functions of the animals producing it, and the care taken in the production and preservation of the resulting manure. Proportionately, urine is much richer in nitrogen and potash than the solid excreta. The nitrogen of urine (in the form of urea) is quickly converted into available plant food, whereas the nitrogen of the undigested food in the solid excrement is but slowly changed into available forms. The cow produces the largest amount of manure, but while this is comparatively the lowest in its content of fertilizing elements, its abundance makes it economically the most important manure in mixed and dairy farming. More than one half of the nitrogen and at least three-fourths of the potash excreted by the cow are to be found in the urine, while most of the phosphoric acid is excreted in the faeces. Horse manure is distinctly richer in nitrogen, phosphoric acid and potash than cow manure; but it ferments more easily, and is thus liable to lose more of its nitrogen. It would be best, therefore to mix cow and horse manure if they are to be left for any length of time in the heap. Sheep manure is very rich in nutrient elements, and when not mixed with straw, contains approximately twice as many units of plant food as cow manure. It is concentrated, can be easily applied, and has therefore been found of special value for top dressing and for fertilizing garden soils, lawns, etc. Analyses have shown that one ton of dried sheep manure is equivalent to approximately four tons of good, fresh, mixed farmyard manure.

Poultry manure is the richest manure produced on the farm. It is particularly valuable for garden and leafy crops. It should be remembered that poultry manure ferments very rapidly and if left exposed loses a large proportion of its nitrogen as ammonia. This manure is generally applied directly to the soil and worked in during the summer after being mixed with earth, but should it be necessary to keep it for some time especially in winter it should be mixed with a proportion of light soil, peat or saw dust, if available together with a little superphosphate or gypsum to fix the nitrogen. Sheep and poultry manure are therefore much richer in plant food constituents than horse and cow manure. Manure in animal sheds does not maintain the same composition; it undergoes certain transformations and decompositions. The mineral substances such as potash, phosphates etc., generally escape these transformations but the nitrogenous organic matter cannot. Urine contains urea, uric acid, etc,. which under bacterial influence are converted into carbonate of ammonia; this fermentation takes place even at a low temperature and increases immensely as the temperature rises. This means a loss of nitrogen which is easily detected in animal

sheds if aeration is inadequate, by the offensive smell and some stinging in the eyes, characteristic of the production of ammonia.

To avoid these losses in nitrogen, experience has taught that the best practical way is to remove the manure frequently and to make it into heaps before fermentation sets in.

The following table shows the estimated quantity of manure obtained per 450 kgs. (about 1000 lb) of live weight:—

	Total excreta per year Tons.	Manure with bedding Tons.
Horse	8·9	12·1
Cow	13·5	14·6
Sheep	6·2	9·6
Calf	12·4	14·8
Fowl	4·3	4·3

Agricultural products as Insecticides. R. C. Roark (*Industr. Eng. Chem.* 31, pp. 168. Euston Pa., 1939). Although the materials now largely used for this purpose (compounds of arsenic, flourine, lead, copper and sulphur) are of mineral origin, vegetable products are being used to an increasing extent. This is because many organic compounds are more toxic to insects but less toxic to man than are lead arsenate and other inorganic poisons. In addition to organic insecticides that exist naturally in plants such as nicotine, ground-nut oil, and other plant oils, products derived from coniferous trees, such as pine-tree oil are also valuable insecticides and synthetic compounds derived from oils alcohols, furfural and other promising plant products are now coming into commercial use as insecticides. It is conjuctured that in the future insecticides will be mostly organic compounds obtained from plants now regarded as worthless weeds or synthesized from products of plant origin. The possibilities of constructive chemical research in this field are boundless and should result in numerous products of great economic value. *Rev. App. Ent.* 27 : (1939) 593.

EXTRACTS

Kapok and the War.

It is probably true to say that many men and women, British and neutrals alike, to-day owe their lives to kapok.* Their boats having been mined or torpedoed, they have been kept afloat by kapok-filled lifebelts and lifebuoys until picked up by other ships. Kapok is the most buoyant of all materials used for life-saving appliances. Its floating power is about five times as great as that of cork, and submerged, it has a carrying capacity of no less than 30 times its own weight. Not only so, but it has the added advantage of losing only 10 per cent. of its buoyancy in 30 days and can rapidly be restored to its former buoyancy simply by drying in the sun. A small pillow will hold one's head above water for days on end. This resilience and buoyancy is caused by the air-filled cells which, under a microscope, can be seen in kapok fibre. The cells are covered on the outside with a waxy substance which renders the fibre impervious to moisture. Java kapok has been approved by the board of Trade as a buoyancy medium in life-saving appliances, which include life-buoys, life-belts and life-jackets, while kapok is also used for pick-up buoys, fenders, cushions, seat cushions and mattresses. Owing to the saving in weight, a kapok-filled lifebuoy can be thrown a greater distance than the old-fashioned lifebuoy. The kapok-filled lifebuoy as used by the Royal National Life-boat Institution weighs only 5 lbs. 6 ozs. and supports 35 lbs. in water for a minimum period of 24 hours. The

* Silk Cotton.

weight of an average man in water is only 9 lbs. Life-buoys depending on kapok for their buoyancy have been approved by the Board of Trade for use in British ships. Life-belts supplied to *R. M. S. Queen Mary* are filled with Java kapok. Similar lifebelts are to be supplied for use in *R. M. S. Queen Elizabath* and *R M. S. Mauretania*. In addition to its lightness and higher supporting power a kapok-filled life-belt lasts longer, and there are no sharp corners to wear through, which minimises the necessity for constant recovering.

Kapok is on "national service" in other directions. The researches of a French army doctor during the last war showed that kapok has the most remarkable antiseptic and healing properties. It can be applied to an open wound and will absorb water. The insulating properties of kapok also make it the ideal bandage or wadding for the alleviation of rheumatism, sciatica, lumbago, bronchial troubles, or whenever warmth should be applied to the body. Again, a Harley Street specialist has designed kapok pneumonia jackets, body belts, kidney pads, rheumatic bandages, and vests for sufferers from bronchitis. The Pasteur Institute in Paris has discovered that kapok can be sterilised by heat several times without losing its properties. It is ideal, of course, for use in aeroplanes owing to its lightness. Nurses find that a mattress of kapok is much easier to turn saving much time and labour in hospitals containing hundreds of beds. *Industrial Fibres Review*, 5 : (1940) 10.

Protection of Stored Grains from insects.

Sprays. Many storage buildings, particularly those in tropics are so constructed as to render fumigation difficult. Insect infestation in such buildings is probably best tackled by means of sprays. Insecticidal sprays may be divided into two types; those which rely on a direct hit, whereby the insect is thoroughly wetted, and those which, after atomization, ultimately settle on the insects. It is only in rare circumstances that a direct hit can be obtained on stored-products-insects and accordingly an atomized spray is essential. A good one consists of an extract of pyrethrum carried in a white oil (kerosene).

* * * * * * *

Dusts. It is well known amongst colonial producers that seeds required for planting can be kept effectively free from insect attack if they are stored in vessels or tins with dry wood ashes. Experiments made by Squire in British Guiana have also shown that weevil damage in rice can be materially reduced by the addition of less than 1 per cent. of calcium carbonate (precipitated chalk) and that in the Federated Malay States it has been found at the Government Rice Mills in Perak that the treatment of stored rice with 5 per cent. slaked lime affords satisfactory protection from insect attack. In British Honduras it is a common practice to add lime when maize is stored in the cob in heaps or bins, with beneficial results.

In recent years the use of dusts for the protection, particularly of grain and cereal products has become more and more general. It is unfortunate that at present no clear understanding of the action of these dusts has yet been attained and there is considerable controversy regarding it. From the practical man's point of view, however, the main point is that these dusts are said to be surprisingly effective and further, the variety of mineral dusts which are effective is considerable. Of the natural mineral dusts, the best known and probably the most effective is a naturally occurring rock phosphate widely known in Egypt under the name of "Katelsousse". This particular dust has been so generally successful that it is now marketed on behalf of the Egyptian Government by Imperial Chemical Industries, Ltd., under that name.

Other effective dusts consist of pure silica and one of these known under the proprietary name of "Naaki" has been widely used in Germany and elsewhere.

It is a German product and will in consequence not be available during the war. Other simple mineral dusts are precipitated chalk, slate dust and china clay. It is quite probable that a number of naturally occurring earths may prove effective. Some firms market or are about to market dusts for which they claim very high efficiency, and particulars of these can be obtained from Imperial Chemical Industries, Ltd.

The use of dusts is simple and consist merely in the mixing of the dusts with the grain or other product to be protected. Their general use is for the protection of grain and seeds, particularly pulses. It is worth noting that while experiments on the elimination of these dusts prior to milling and baking of grain are still in progress, the general opinion is that this elimination need present no difficulty, and further that many of the dusts mentioned are innocuous to the alimentary tract. Where dusts such as lime or powdered chalk are used in stored rice their elimination occurs when the rice is washed, as is customary prior to cooking.

Of all the methods of protecting grain and seeds in particular against insect attack it would seem that the use of dusts is much the most promising. *Jour. Jamaica Agri. Soc.* 44: 157—158.

Gleanings.

Black-heart of Potatoes. Black-heart is induced by a deficiency of oxygen within the tissues of tubers. This may be brought about by high temperatures which increase the rate at which oxygen is consumed by the potato cells, or by storage under conditions where the supply of air is inadequate for the respiratory requirements of the cells. The death of the cells is followed by the production of pigments which gives rise to pink, brown and black colours characteristic of the various stages of black-heart. The final colour is jet black and this has given rise to the name of black-heart.

Symptoms. The symptoms of black-heart vary depending on whether the tubers are exposed to high temperatures with a normal air supply or to high, low or medium temperatures with an insufficient air supply. In the former case, there are internal symptoms only; in the latter, both internal and external symptoms may develop. Black-heart may, under certain conditions, develop in the field, but it occurs most frequently where large quantities of potatoes have been stored in a confined space.

Control. If given a good supply of air, tubers do not usually develop black-heart at temperatures below 95° F. Control, therefore, involves storage of the tubers at temperatures less than 95° F. with good ventilation. Moreover, if tubers must be stored in a confined space, the temperature should be kept as low as possible and arrangements made for ventilation, if this is feasible. As black-heart may sometimes occur in the field as well as in storage, the tubers should not be left long in hot soils after the vines have died or be left long on the soil surface after digging during hot weather. (*Agr. Gaz. N. S. Wales* 51 : 259—260).

The distribution of Insects, Spiders, and Mites in the Air. A discussion of the results of an investigation carried out during the years 1926—31 inclusive, to test the height to which insects can ascend in the air. The collection of the insects was facilitated by means of special traps fitted to the airplane wings. Some 1,314 flights were made in Louisiana and 44 flights in Mexico, the traps being in operation for 1,007 hours; 30,033 specimens of insects and spiders were taken at altitudes ranging from 20 to 15,000 feet; 18 orders of insects and spiders and mites were collected, Diptera being the most abundant, followed by Coleoptera. Homoptera and Hymenoptera were taken at 14000 feet—the highest altitude at which insects were found—but a spider was caught at 15,000 feet, the

highest altitude at which any specimen was taken. Temperature was the most important factor regulating the numbers of insects found in the air at any given time; the optimum range was from 75° to 79°F. surface temperature. The maximum numbers of insects were found at sunset, at which time many crepuscular and night-flying moths, together with the day forms, were active. Rain after a long period of drought caused an increase in insect activity, and greater numbers were found in the upper air at such time. In the airplane collections of insects in Mexico the pink bollworm moth was found as high as 3,000 feet. This and other studies indicate that the pink bollworm moths are carried in the upper air currents for considerable distances. (*The Empire Cotton Growing Review*, 17 : 43).

Making full use of our Farms. In the days before we had good roads and modern cars the farm was much more self-sufficient. Those were the days of the farm garden and orchard, when the farmer's wife kept the family fed on the produce of the farm. Now we have swung to the other extreme. It has become an age of specialisation, even with farmers. We have left off mixed farming in order to devote all our time to practically a single crop. The family fruit garden is on many farms no more, the vegetable garden a neglected weed patch; and some farm families eat most of the food out of tin cans. One often has to go a long way to find a farmer who has discovered the true art of living cheaply and well. It is, unfortunately, a rare sight to see a good vegetable garden on a farm. Home-grown products have been unfashionable, and the result is that many farmers wonder why their living costs are so high. By reviving the custom of our fathers and mothers in making the farm furnish more of our living, we would find that we had solved part of our economic problems and at the same time be living better. To-day, thanks to refrigeration, the famer's wife has actually better chances of making more use of the products of the farm for her own table. (*Queensland Agr. Jour.* 53 : 598.)

Farms as Gilt-edged Securities. It is only in troubled times like the present that the man with money seems to realise that for real wealth--for something that is everlasting and tangible—he must go to the source of all life, the land. And that, judging from reports from all over Great Britain, is what he is doing now. In most districts in the old Country the demand for farms and estates of almost any size far exceeds the supply. It is not only those with money to invest however, who are interested in good farms to-day, for there are enquiries on all hands from men who see a period of stability coming to farming, and who hope that the industry may remain stable even when the war is over.

This is the opinion of one buyer who has a mere £ 150,000 to invest and which he is willing to risk in the first class agricultural and dairy farms :— "There is no question but that the public to-day realise that food producing land is the finest gilt-edged security that it is possible to purchase".

(*Queensland Agr. Jour.* 53 : 594).

Correspondence.

We reproduce below an appeal issued by A. R. C. Westlake Esq., I. C. S., Director of Agriculture, Madras inviting Agricultural Propaganda material. Ed. M. A. J.]

To

The Editor,

The Madras Agricultural Journal.

Sir,

An Appeal.

I require propaganda material for supplying to All-India Radio Stations. It has been observed that straight-forward talks on agricultural subjects do not

hold the attention of the audience. What is required is a dialogue or a short play, if possible with human interest and entertainment value. I shall be glad to receive dialogues, sketches or short plays in Tamil and Telugu containing agricultural propaganda from members of the Department and from present and past students of the Agricultural College. It is suggested that authors will be assisted in writing a 'live' sketch if they write down a detailed description of the personages in their dialogue or sketch with a little imaginary history for each person.

Authors might also remember the popularity of the speaking animal as shown by the *Pancha Tantra* stories and the Walt Disney cartoons, (Micky Mouse etc.) Some effective dialogues might be written between a conservative cultivator and a cow or other animal gifted with speech through whose mouth good advice might be given. Sketches might also be enlivened by short songs set to well known tunes which could be sung without difficulty by people at the Radio Studio. I am prepared to pay from my own pocket from Rs. 5 to Rs. 10 for each dialogue or sketch that is broadcast. It is also possible that if material of merit is submitted, authors might find a future market with All-India Radio for other material.

Authors should send their manuscripts direct to me at my office in Madras.

Madras, }
1—8—40, }

Yours etc.,
A. R. C. Westlake.

Crop and Trade Reports.

Statistics—Crop—Sugarcane—1940—First report. The average of the areas under sugarcane in the Madras Province during the five years ending 1938-39 has represented 2·8 per cent. of the total area under sugarcane in India.

The area under sugarcane up to 25th July 1940 is estimated at 129,720 acres. When compared with the area of 102,910 acres estimated for the corresponding period of last year, it reveals an increase of 26·1 per cent. The increase in area is general outside East Godavari, Nellore, Coimbatore and Tinnevelly and is due to the high price for jaggery which prevailed just before the planting season. The increase in area is marked in South Arcot (9,000 acres), Vizagapatam (5,000 acres), North Arcot (3,200 acres), Salem (2,700 acres) and Kistna (2,200 acres). The area estimated for Bellary, South Arcot and Tanjore is the highest reported in recent years.

The condition of the crop is satisfactory except in Vizagapatam where the crop was adversely affected by the very heavy rains of May.

The wholesale price of jaggery per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 5th August 1940 was Rs. 5-11-0 in Mangalore, Rs. 5—4—0 in Salem, Rs. 5—0—0 in Erode, Rs. 4—15—0 in Rajahmundry and Cuddalore, Rs. 4—13—0 in Vizianagaram, Rs. 4—10—0 in Cocanada, Rs. 4-5-0 in Chittoor, Rs. 4-2-0 in Adoni and Vellore, Rs. 3-14-0 in Coimbatore, Rs. 3-10-0 in Vizagapatam, Rs. 3-7-0 in Bellary and Rs. 3-4-0 in Trichinopoly. When compared with the prices published in the forecast report issued at this time last year, these prices reveal a fall of approximately 58 per cent. in Adoni, 50 per cent. in Vizagapatam, 46 per cent. in Bellary and Trichinopoly, 41 per cent. in Vellore, 40 per cent. in Chittoor, 37 per cent. in Cocanada, 35 per cent in Rajahmundry, 28 per cent. in Salem, 27 per cent. in Vizianagaram and Cuddalore, 24 per cent. in Mangalore and 22 per cent. in Erode.

Statistics—Crop—Groundnut—1940—Second report Summer Crop—The area under the summer or irrigated crop of groundnut in parts of the Madras Province during the five months—January to May 1940—is estimated at 120,300 acres. The harvest of the crop is in progress. The yield is expected to

be normal in all districts except Chingleput and South Arcot. The total yield is estimated at 100,100 tons of unshelled nuts.

Early crop—Area and yield. The area under the early crop of groundnut (mostly unirrigated) up to 25th July 1940 in the districts of Salem and Coimbatore is estimated at 153,000 acres. When compared with the area of 142,000 acres estimated for the corresponding period of last year, it reveals an increase of 7·7 per cent. A normal crop is reported from both the districts. The total yield is estimated at 76,500 tons of unshelled nuts as against 66,200 tons estimated for the corresponding period of last year.

The wholesale price of groundnut (shelled) per imperial maund of 82⅐ lbs. (equivalent to 3,200 tolas) as reported from important market centres on 12th August 1940 was Rs. 4—12—0 in Vizagapatam, Rs. 4—8—0 in Vizianagaram, Rs. 4—5—0 in Cuddalore, Rs. 4—3—0 in Guntur, Rs. 3—15—0 in Hindupur, Rs. 3—14—0 in Nandyal, Rs. 3—11—0 in Bellary, Rs. 3—8—0 in Adoni and Cuddapah and Rs. 3—3—0 in Tadpatri. When compared with the prices published in last report, i.e.. those which prevailed on 8th July 1940, these prices reveal a rise of approximately 19 per cent in Vizagapatam, 15 per cent in Hindupur, 13 per cent in Nandyal, 10 per cent in Guntur, 6 per cent in Vizianagaram, 5 per cent in Cuddalore, 4 per cent in Cuddapah and 2 per cent in Tadpatri and a fall of approximately 3 per cent in Adoni, the price remaining stationary in Bellary.

Statistics—Crop—Gingelly—1940-41—First Forecast Report. The average of the areas under gingelly in the Madras Province during the five years ending 1938-39 has represented 16·2 per cent. of the total area under gingelly in India.

Area The area under gingelly up to 25th July 1940 is estimated at 344,200 acres as against 366,100 acres estimated for the corresponding period of last year. The estimated area is the same as that of last year in Cuddapah, South Arcot and the West Coast; a decrease in area is revealed in Kistna, Guntur, Bellary, Anantapur, Nellore, Chingleput (-7,000 acres), Chittoor, North Arcot, Salem (-30,000 acres) and Ramnad, partly counterbalanced by an increase in area in the rest of the Province, especially in East Godavari (9,000 acres), Vizagapatam and West Godavari (5,000 acres in each).

Yield. The yield per acre is expected to be normal in all the districts except Vizagapatam.

The wholesale price of gingelly per imperial maund of 82⅐ lbs, (equivalent to 3,200 tolas) as reported from important markets on 5th August 1940 was Rs. 7-4-0 in Trichinopoly, Tinnevelly and Tuticorin, Rs. 7—3—0 in Cuddalore, Rs. 7—0—0 in Cocanada, Rs 6—15—0 in Ellore, Rs. 6—12—0 in Vizianagaram, Rs. 6—7—0 in Rajahmundry, Rs. 6—0—0 in Vizagapatam and Rs. 5—12—0 in Salem. When compared with the prices published in the report for the corresponding period of the previous year i. e., those which prevailed on 7th August 1939, these prices reveal a rise of approximately 33 per cent in Trichinopoly, 28 per cent in Salem, 26 per cent in Cuddalore, 21 per cent in Tuticorin, 17 per cent in Ellore, 16 per cent in Tinnevelly, 13 per cent in Vizianagaram, 8 per cent in Cocanada, 2 per cent in Vizagapatam and 1 per cent in Rajahmundry.

(From the Director of Industries and Commerce, Madras).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 16th August 1940 amounted to 398,480 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939-40. The receipts in the corresponding period of the previous year were 387,057 bales. 383,872 bales mainly of pressed cotton were received at spinning mills and 109,642 bales were exported by sea while 86,133 bales were imported by sea mainly from Karachi.

(From the Director of Agriculture, Madras).

College and Estate News.

Students' Corner. An interesting debate was held on 5—8—40 with Sri Seshavataram (student) in the chair the subject being 'whether women students should be admitted into the Agricultural College'. Sri Narayanamurthy opened the debate and the disscussions from varying angles of vision followed successively. The resolution in favour of the admission of women was carried. Sri Kantiraj, the observer, gave expression to some of his impressions on the debate for the benefit of the students.

Mr. R. C. Broadfoot. At an urgent general body meeting of the Students' Club on 19th August '40 a resolution was passed, praying for the quick recovery and restoration to normal health of Mr. R. C. Broadfoot the President of the Club, who was proceeding to Madras for treatment. A hearty send-off was given to Mr. Broadfoot on the railway platform as he left for Madras, by the students of the College.

Games. *Hockey.* The opening match of the season was played against the Central Recruits School team on the school grounds and our college won the match by 5 goals to nil. In a match played against the Coimbatore United Club our College won by 3 goals to 2. The matches played against Government College and Papanayakapalayam ended in goal-less draws. The College sustained the first defeat of the season in a match played against Madukarai Cement Factory Club by 3 goals to 2. In a match played against the Union Christian College, Alwaye, on 17—8—40 we won 5 goals to nil. The Union College avenged their defeat by winning a volley ball match against us when they snatched victory after a tough fight.

Cricket. The opening match of the season was played between Sri H. Shiva Rao's XI and Sri K. M. Thomas's XI and the match ended in a victory to the former. Sri H. Shiva Rao's XI—125 all out; H. Shiva Rao 34 retired. Shanker Rao 36; Hegde 3 for 22, Somanna 2 for 14.

Sri Thomas's XI -94 all out. K. M. Somanna 43, B. S. Krishnan 11. S. V. Srinivasan 6 for 35, Kodandaraman 3 for 41.

On 4—8—40 a match was played against the Scouts Recreation Club on our grounds. The College batting first, declared the innings at 152 for 7 wickets. H. Shiva rao (54 retired) K. M. Somanna (23) C. Shanker Rao (17) and Deva Doss Kamath (14) were the chief run-gatherers. S. R. C. XI :— 72 for 7 wickets. B. S. Krishnamoortby 29; Hegde 4 for 9 and Somanna 3 for 14

On 18—8—40 in a friendly match between Sri H. Shiva Rao's XI and C. N. Babu's XI, the former were all out for 169. B. S. Krishnan 52, Nambiar 34, S. V. Sreenivasan 15, Shanker Rao 35. Babu's XI ;— 54 all out. Nageswar Rao 13, S. V. Sreenivasan 20, Reddiar 2 for 1

Foot Ball. In the first match played against the Ranganadhapuram Recreation Club, the College sustained a defeat by 3 to 2 goals. In another match played against Municipal High School, our College lost by 2 to 1 goal.

Personal. Consequent on the two month's leave granted to Mr. R. C. Broadfoot, Senior lecturer in Agriculture and Superintendent, Central Farm and Principal of the College, Rao Bahadur Sri. G. N. Rangaswami Ayyangar, Millets Specialist and Geneticist has been appointed Principal and Sri. K. Unnikrishna Menon, Deputy Director of Agriculture, IV Circle appointed as Senior Lecturer and Superintendent. Mr. C. Ramaswami, Deputy Director of Agriculture, II Circle, has been appointed as Deputy Director of IV Circle, Coimbatore. We offer our felicitations to these officers.

Information has been received that Mr. C. Jaganatha Rao, B.A., M.Sc., of the Cotton Specialists' Staff and Farm Manager, Agricultural Research Station, Nandyal, has been selected for appointment under the Imperial Council of Agricultural Research as Agricultural Experimentalist, Imperial Agricultural Research Institute, New Delhi. We offer our congratulations to Mr. Jaganatha Rao.

Governor's War Fund. There has been a spontaneous response among the officers of the Agricultural Department to the appeal issued by H. E. the Governor of Madras for contributions to the War fund. His Excellency's own example in contributing one day's salary per month for six months has been emulated by almost all the officers of the department. Many among the Subordinate officers drawing a salary below Rs. 100 have made such contributions though H. E.'s appeal was not made to them.

Trinket Collections in aid of the War. The ladies of the estate have not lagged behind their sisters in other parts of the province in making their own contributions to the War fund. Collections in the form of gold and silver trinkets were made by a band of enthusiastic ladies and it is hoped that a substantial collection in this form will be made.

Moffusil News and Notes.

Erode Agricultural exhibition. The Agricultural exhibition along with the Health and Veterinary exhibits, was held in the municipal reading room building situated in Peoples' Park about a mile away from the Erode town.

The exhibition was declared open by Sri. K. Kamaraja Nadar, M. L. A., and President, Tamil Nad Congress Committee at 5-30 p m. on 28-6-1940 after the inauguration of the Health and Baby Week celebrations by Sri. S. Satyamurthi, M. L. A. (Central) the Mayor of Madras Corporation. Visitors both from the urban and rural parts came in large numbers to see the exhibition. The agricultural exhibits such as best seeds, varieties of sugar and sugarcane, the various kinds of implements and the best products from ryots' fields were arranged so as to draw the attention of the large crowd. By means of explanations and demonstrations, the necessity of improving agriculture and farming by adopting scientific methods and using improved implements was impressed upon the people. The stalls were crowded throughout and the average attendance per day exceeded 600 of which ryots' population would be about 40 per cent. The Health and Baby Week celebrations came to an end on 4th July 1940.

Sri. Kulasekaram Naidu, Revenue Divisional Officer, Erode, presided over the last day's function and distributed prizes and certificates of merit to the competitors and to the best exhibits. One certificate of merit to the Agricultural Department stall and four of the same with two silver medals were awarded to four ryots for having exhibited the best produce from their lands. With a hearty vote of thanks by Sri. R. K. Venkataswamy, Chairman, Municipal Council, Erode, the function came to a successful termination.—K. U. M.

Shiyali (Tanjore District). An Agricultural exhibition was held in connection with the Thirumulaipal festival. Besides the usual display of paddy and rice samples of the different strains and improved ploughs and other implements recommended to the rice grower, live specimens of a large range of green manure and fodder plants, and 'Korai' mat grasses raised in pots, and the attractive display of locally grown fruits like sapotas, figs, pomeloes, Sathgudi oranges and mangoes formed a special feature of the exhibition. The other exhibits included different breeds of poultry, bee hives smokers, and honey extractors. Fairly large crowds were attracted to the exhibition daily and the importance of the different exhibits explained to the interested visitors.—M. A.

Avadayarkoil. During the Anithirumanjanam festival at Avadiyarkoil (Arantangi Taluk) an Agricultural exhibition was conducted from 7—7—40 to 10-7-40. His Holiness Namasivaya Thambiran, Trustee of the Avadiyarkoil temple gave hearty co-operation and necessary assistance in the conduct of the exhibition. All agricultural improved implements, different strains of paddy and groundnut and green manure seeds were exhibited at the stall. The economic advantage of using such improved implements and seeds were explained to the visitors. Leaflets were distributed. Lantern lectures on improved methods of agriculture were also delivered. The Health Department and the District Board, Tanjore also participated in this exhibition. About 1000 people visited the exhibition stall.—A. G. N.

Weather Review—JULY 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	11·4	+4·5	43·0	South	Negapatam	1·9	0·0	5·9
	Calingapatam	6·2	+0·9	26·3		Aduthurai *	1·6	+0·3	10·3
	Vizagapatam	3·3	-1·2	17·1		Madura	0·9	-1·0	13·5
	Anakapalli*	3·7	-1·3	23·7		Pamban	0·0	-0·6	11·5
	Samalkota*					Koilpatti*			
	Maruteru*	7·4	+0·1	17·8		Palamkottah	0·0	-0·4	7·0
	Cocanada	5·2	-0·6	22·4					
	Masulipatam	6·2	-0·2	11·5					
	Guntur*	6·0	+0·2	16·3	West Coast	Trivandrum	6·6		39·0
						Cochin	36·4	+13·6	76·2
Ceded Dists.	Kurnool	3·9	-0·9	11·7		Calicut	44·3	+14·1	80·1
	Nandyal*	4·2	-1·8	6·3		Pattambi *	35·0	+9·2	60·9
	Hagari *	1·0	-1·0	11·8		Taliparamba *	54·2	+9·1	92·0
	Siruguppa*	2·4	-0·7	9·5		Kasargode *	46·1	+4·1	88·6
	Bellary	1·1	-0·7	12·0		Nileshwar*	52·9	+10·0	99·9
	Anantapur	0·2	-3·2	5·7		Mangalore	45·0	+7·9	79·8
	Rentachintala	6·3		12·5					
	Cuddapah	2·3	-1·6	18·1					
	Anantharaju-pet *	3·5	-0·8	13·3	Mysore and Coorg	Chitaldrug	5·0	+1·9	13·6
						Bangalore	1·7	-2·5	15·7
Carnatic	Nellore	1·1	-1·7	12·8		Mysore	3·3	+0·7	17·0
	Madras	4·1	+0·2	11·1		Mercara	44·8	-2·1	92·5
	Palur*	2·8	+0·1	7·2					
	Tindivanam *	0·8	-1·0	9·2	Hills	Kodaikanal	3·6	-1·4	27·8
	Cuddalore	1·8	-1·3	7·2		Coonoor			
Central	Vellore	1·5	-3·8	10·4		Ootacamund *	3·8	-1·5	29·3
	Salem	3·5	-0·3	19·9		Nanjanad *	5·2	-5·6	26·8
	Coimbatore	0·8	-0·7	14·8					
	Coimbatore A. C. & R. I.*	1·1	-1·0	11·9					
	Trichinopoly	0·0	-1·6	9·3					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

General. The monsoon was generally active over the whole country and was vigorous in Malabar, Konkan and the Bombay Deccan.

Four depressions of the Bay of Bengal and one depression of the Arabian Sea were responsible for widespread rainfall. Skies were moderately to heavily clouded in Mysore and Malabar and lightly to moderately clouded in South East Madras and North Bombay Deccan and clear or lightly clouded in the North Madras coast. Humidity was in excess in the Bombay Deccan, Hyderabad and Mysore and was in defect in North Madras Coast. Maximum temperatures were below normal in North Hyderabad, Mysore, Madras Deccan and North Madras Coast and normal elsewhere. The highest maximum of 102°F was recorded at Madras on the 6th.

The rainfall however was in defect generally except in the West Coast and parts of Circars and Mysore.

The chief falls of rain were :

Mahabaleshwar	...	6·0″ on 15th.
Mangalore	...	7·7″ on 17th.
Cochin	...	4·9″ on 14th.
Calicut	...	4·8″ on 14th.
Taliparamba	...	4·3″
Kasaragod	...	4·2″
Nileshwar	...	6·1″

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 7/40.

Absolute maximum in shade	...	...	89·0°F
,, minimum ,,	...	...	67·8°F
Mean maximum in shade	...	...	85·3°F
Departure from normal	...	...	−1·2°F
Mean minimum in shade	...	...	72·5°F
Departure from normal	...	...	+0·2°F
Total rainfall for the month	...	...	1·13″
Departure from normal	...	...	−1·0″
Heaviest fall in 24 hours	...	...	0·21′
Total number of rainy days	...	...	5
Mean daily wind velocity	...	...	6 m. p. h.
Departure from normal	...	...	−2·6 m. p. h.
Mean humidity at 8 hours	...	...	73·3%
Departure from normal	...	...	+1·4%

Summary. The monsoon was active during the month. The rainfall was 1·13″, which was 1·0″ below normal. Skies were moderately to heavily clouded and the humidity was in excess. The mean maximum temperature was slightly below normal while the mean minimum was slightly above normal.

Departmental Notifications.

Gazette Notification.

1. Appointments.

1. Sri. Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist and Geneticist, Coimbatore to be Millets Specialist and Geneticist and Principal, Agricultural College, Coimbatore from the 20th August 1940 or date of taking charge from Mr. R. C. Broadfoot who has applied for leave.

2. Sri. K. Unnikrishna Menon, permanent Assistant Director of Agriculture and officiating Deputy Director of Agriculture, IV circle, Coimbatore to officiate

as Senior Lecturer in Agriculture and Superintendent, Central Farm, Coimbatore from the 20th August 1940 or the date of taking charge from Mr. R. C. Broadfoot.

2. Transfers.

Name of officers.	From	To
Sri. S. Sitarama Patrudu,	Asst., D. A. (on leave),	Asst., D. A., Rajamundry.
,, M. Veeraraghava Rao Naidu,	Asst., D. A., Rajamundry,	Asst., D. A., Vizagapatam.
,, P. Subrahmanyan,	Asst., D. A., Vizagapatam,	Asst., D. A., St. Thomas Mount.
,, C. Ramaswamy Nayudu,	Offg. D. D. II circle, Cuddapah.	D. D. A. IV circle, Coimbatore.

3. Leave.

Name of officers.	Period of leave.
Sri. Rao Bahadur Y. Ramachandra Rao, Govt. Entomologist, under the I. C. A. R., New Delhi.	L. a. p. for 4 months and leave on half average pay for 5 months and 10 days from 1–6–1940.
Mr. R. C. Broadfoot, Principal, Coimbatore.	L. a. p. for 2 months from 20–8–'40.

Subordinate Services.

1. Appointment.

The services of Sri. N. Kesava Ayyangar, Assistant in Cotton are placed at the disposal of the Government of India for three years for appointment as Cytological Assistant under the Indian Central Cotton Committee in the scheme relating to the Interspecific hybridisation in cottons at Surat.

2. Promotions.

The following grade promotions of Lower Subordinate in Category 2—class I, Madras Agricultural Subordinate Service are ordered with effect from 1st April 1940:—

From IV grade Rs. 75—4—95 to III grade Rs. 100.

1. Sri. E. N. Rangaswami Ayyangar, Assistant Agricultural Demonstrator, Tindivanam.
2. Sri. C. K. Subrahmanya Ayyar, Sub Assistant in Entomology, Coimbatore.
3. Sri. R. Venkatarama Ayyar, now on foreign service as Market-yard Superintendent under the Groundnut-Market Committee, Cuddalore.

3, Transfers.

Name of officers.	From	To
Sri K. Purushottam,	A. D., Guntakal	A. D., Gooty.
,, T. Devasighamany,	A D., Gooty,	A. D., Proddatur.
,, M. K. Gopalan	A. D., Proddatur,	A. D., Sullurpet.
,, V. Ratnaji Rao,	A. D., Sullurpet,	Kalahasti Farm.
,, P. Krishnamurthi,	A. D., Salur,	A. D. on special duty Sugarcane Growers Co-operative Society, Bobbili.
,, G. Kameswara Rao,	F. M., A. R. S., Samalkota,	A. D., Ongole.
,, M. V. Narasimha Sastri,	A. A. D., Kothapeta,	Asst., F. M , A. R. S., Samalkota.

Janab Muhammad Abbas Sahib.	A. D., Gudiyatam.	F. M., Central Farm. Coimbatore.
Sri K. P, Sankunni Menon,	F. M., Central Farm, Coimbatore,	A. D., Cheyyar.

4. Leave.

Name of officers.	Period of leave.
Sri R. Guruswami Naidu, A. D., Kaikalur,	L. a. p. for 30 days from 1—8—40.
,, D. S. Subramania Ayyar, A. D., Nilakottai,	Extension of l. a. p. for 15 days and l. a. p. on m. c. for 3 months from 2—7—40.
,, T. D. Eswara Ayyar, Asst., F. M., Sim's Park, Coonoor,	Extension of leave on half average pay for 1 year and 13 days from 2—8—40.
,, K. H. Subramania Ayyar, A. D., Avanashi,	L. a. p. for 1 month from 30—7—40.
,, V. Ratnajirao, A. D., Sullurpet,	L. a. p. for 4 months from 15—8—40.
,, P. K. Kannan Nambiar, F. M., A. R. S., Nileshwar II Station,	Extension of l. a. p. for 1 month from 1—8—40.
,, K. Rajabapaniah, F. M., A. R. S.. Guntur,	Extension of leave on loss of pay for six months from 30—7—40.
,, K. B. Viswanatham, A. R. S., Maruteru,	Extension of l. a. p. for 3 months from 4—8—40.
,, V. V. S. Varadarajam, F. M., A. R. S., Guntur,	L. a. p. for 1 month from 8—8—40.
,, K. Govindan Nambiar, F. M., A. R. S., Nanjanad,	L. a. p. for 2 months from 5—8—40.
,, C. T. Ittyachan, Asst. to the Oilseed Specialist,	Earned lerve for 33 days from 19—8—40.
,, J. Suryanarayana, A. D, Gurzala.	L. a. p. on m c. for 3 months from the date of relief.
,, D. Shunmugasundaram Pillai, A. D., Aruppukottai.	Extension of l. a. p. for 1 month from 13—8—40.
,, T. V. Krishnaswami Rao, A. D., Vizagapatam.	L. a. p. on m, c. for 2 months from 26—7—40.
,, K. M. Jacob, A. D (on leave).	L. a. p. on m. c. for 1 month from 11-8-40.
,, E. K. Govindan Nambiar, F. M. (on leave).	Extension of l. a. p. on m. c. for 4 months from
,, K. Raghunatha Reddy, Agri. Marketing Asst., Madras.	Earned leave for 2 months from 19—8—40.

An Announcement.

Wanted. Assistant Marketing Officer (temporary) for 3 months from 1st October 1940. with prospect of continuance. Commencing salary Rs. 200 per mensem on a scale of Rs. 200—20—500.

Qualifications. Accustomed to rural environment. University degree in Agriculture or Economics. Knowledge of Statistics. Ability to write good English. Preferably with practical experience or commercial knowledge of Agricultural Marketing Survey work.

Applications to be submitted by 10th September to ;— The Agricultural Marketing Adviser to the Government of India, Old Secretariat Buildings, Civil Lines, Delhi.

The Madras Agricultural Journal.

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EDITORIAL

Ths Madras Groundnut Trade. With an area of 3.7 million acres under groundnuts, Madras is the largest producer of groundnuts in India and the value of the provincial produce is estimated at 20 crores of rupees. For these reasons groundnut has become the chief 'cash crop' of the province. Though a considerable quantity of the produce is used up for internal consumption, the export from the province in 1938—39 reached 765,000 tons valued at nearly 9 crores of rupees. European countries, particularly France, were the principal consumers of Indian groundnuts, but with the sudden collapse of France and the closure of other continental markets, the entire export trade in this commodity was dislocated, creating a situation unprecedented in the annals of the industry. Great Britain though herself a large importer, could not absorb more than a fraction of the exportable surplus. Faced with the prospect of a large surplus and the consequent slump to uneconomic price levels, urgent representations were made to the Government of India by the local Government and the producing and marketing interests. It is a matter for gratification that the Government of India responded quickly and Sir A. Ramaswami Mudaliyar, the Commerce Member spared no pains to study the situation in all its intricate details. A conference of all interests was arranged in Madras under the chairmanship of the Commerce Member and the frank discussions which followed have brought out several interesting points. Various suggestions were put forward such as restriction of cultivation, storing of surplus produce by a Government or quasi-government agency, increase in internal consumption and exploring alternative uses for the nut and oil. We are afraid that the proposals to restrict cultivation of a crop which is raised in small areas by millions of small farmers is beset with difficulties. So is the problem of storage also. To us, the more feasible proposals appear to be the increase of internal consumption of nuts and finding of additional uses for the oil. We are glad to note that the commerce member assured the conference that intensive researches were being done to utilise groundnut oil for the manufacture of lubricating oils and endeavours made to expand the production of 'vegetable ghee' for which there was a growing demand in the country. India should avail the present opportunity to crush the oil seeds produced in the country and take to the manufacture of a

variety of products which she imports from abroad or for which the world markets are still open. This will not only develop a self contained industry of immense commercial value to her, but make available in the country vast quantities of valuable oil cake which her soils and livestock sorely need.

The Indian Poultry industry. The report on the marketing of eggs in India and Burma released by the Marketing section of the Government of India reveals interesting facts about 'this profitable but sadly neglected branch of Agriculture'. The startling figures furnished in the report should serve an eye-opener to many who have the interests of our rural population at heart. India possesses $10\frac{1}{2}$ percent of the world's poultry population but still remains an insignificant contributor to the world's egg trade. She is credited with the possession of 522 lakhs of laying fowls but among these only 7·3 lakhs or 1·3 per cent represents improved breeds of which over two-thirds are in one province—the United Provinces. For every 100 laying birds 230 non-laying birds are maintained which reveals a deplorable case of uneconomic production. Nevertheless India produces annually 33,648 lakhs and Burma 1,636 lakhs of eggs which if laid end to end will go four times round the circumference of the earth. The total value of the eggs sold in a year amounts to Rs. $5\frac{1}{4}$ crores and the birds themselves are worth $7\frac{1}{2}$ crores. Due to a variety of causes, the total loss to the egg industry every year is estimated at Rs. 57 lakhs of which 14 lakhs are attributed to inadequate housing, 15 lakhs to breakage in the course of collection, transit and distribution and 28 lakhs to staling in the course of marketing. Though the industry is of such great importance to the country, it is a sad commentary on the country's interest in her rural masses that only a sum of Rs. 74,000 is spent by 17 provinces and states on attempts at the improvement of poultry-keeping. India claims to have over 100,000 co-operative societies, but only seven of them are concerned with eggs, and of these only one lays claim to successful working without loss. It is high time that the country should take stock of the present situation and organise an effective drive for the improvement of this valuable cottage industry.

Soy Bean Trials in Madras.

By M. ANANDAN, L. Ag.,

Assistant Director of Agriculture, Cuddalore.

Introduction. Soy bean plant (*Glycine max*, Merr.) has been known to, and cultivated by, the Mongoloid races for several centuries as one of their most important food crops and feed for their domestic stock, while it was not even widely known to the other races of mankind until so late as the 18th century. Manchuria, China, Korea and Japan were, and are still the chief countries of production and export of this most important leguminous crop to the other parts of the world. Soy bean seed is very rich in protein and fat of high biological value and contains vitamins A, B and D and is a good source of minerals like calcium, sodium, phosphorus and manganese. Its starch content is very low and is therefore of particular value as food for diabetics. The seed is used in a variety of ways as food by the Chinese and the Japanese. Soy bean meal and oil-cake are excellent feed for cattle, and the crop when cut and fed green or converted into hay forms a very valuable fodder rich in nitrogen comparable to alfalfa (lucerne) and clover in feed value.

The cultivation of soy bean was started in the United States of America more than one hundred years ago, but the area occupied by it was very small and was only 2,000 acres in extent till 1914. From that year onwards the expansion of the area under the crop was very rapid and at the present day it is reported to be occupying nearly six million acres in that country. Nearly 56 per cent of all the soy beans grown there is for use as hay. It is reported that soy bean hay cut at the proper time and well cured is almost equal, ton for ton, to alfalfa.

Trials in Madras. As far as is known to the writer, the first trial of soy bean in Madras was made in 1915-16 by Mr. R. Cecil Wood, then Principal of the Agricultural College, Coimbatore in one of the fields on the Central farm. The crop was a fair one but its cultivation was not continued in subsequent years.

Great interest in this crop was aroused in India about 1932—33 as a result of Major General Sir Robert McCarrison's advocacy for the inclusion of soy bean as a very cheap and valuable source of first class vegetable protein in the average Indian diet, which badly lacks it. Another contributary cause for the spurt of such enthusiasm of the people in this new food crop was the decision of Mahatma Gandhi to give it a trial by including it in his daily diet. It is not known whether soy bean still finds a place in the Mahatma's daily diet. A third reason for stimulating the interest of the people was the fact that soy bean was becoming a serious competitor in the overseas market with the Indian groundnut, the premier oil seed crop of the country. The result of all this at the time was a great demand for soy bean

seed and for information regarding its cultivation. But unfortunately, the Department of Agriculture could not help the public either with the seed or information regarding the cultivation of soy bean as it had not been grown or tried on any of the Agricultural Research Stations before, except once on the College Farm in 1915-16. The Department, however, lost no time in taking up the trial of this new crop. The Director of Agriculture, Madras obtained seeds of soy beans from various sources and distributed them to several Research Stations in the Presidency for trial and study of the crop under varying soil and climatic conditions. For the first two seasons, small samples of seed received were grown for seed multiplication. Field trials were carried out from 1935 onwards. The summary of the results obtained at the several Research Stations is given below.

Agricultural Research Station, Hagari (average rainfall 20 inches) Two varieties, *Kachin* and *Pe Ngype*, both from Burma were tried for two seasons as a dry crop and for one season under irrigation. The yields given by these two varieties as dry and irrigated crops are given below :—

Nature of Crop.	Yield of seed in lb.		Remarks.
	Behrum.	*Pe Ngype.*	
Dry crop	230	94	The crops were subject to the attack of *Surul* caterpillar. (*Stomopterix nerteria*).
Irrigated crop	59	333	

Five other varieties were also tried in $1\frac{1}{2}$ cent plots in 1937—38 season. Of these, variety No. 18 gave 375 lbs. of grain per acre.

Agricultural Research Station, Nandyal (annual rainfall 28 inches) On this station also, *Pe Ngype* and *Behrum* were the varieties tried on a bulk scale, while, 5 other varieties were tried on a small scale. The yields given by all the varieties were very poor on this station also, as will be evident from the figures given below :—

Name of variety.	Area in acres.	Yield of grain per acre in lb.	Remarks.
Pe Ngype.	2·08	200	The crop was subject to the attack of leaf rollers and millipedes.
Behrum.	0·85	88	
Laredo.	0·09	50	
M. S. 28	0·10	90	
,, 33	0·10	80	
,, 26	0·09	140	
,, 31	0·09	150	

A crop of *Pe Ngype* grown under irrigation was no better in grain yield as it gave only 135 lbs of grain per acre. But this variety grew well as a fodder crop, though it was badly damaged by caterpillars.

Central Farm, Agricultural College, Coimbatore. (annual rainfall 25 inches). The trials on this station were conducted during 1936-37 and 1937-38. In the year 1936-37, twenty four varieties were tried during the South-west monsoon season in garden land with red loamy soil. Of these, Kuala-lumpur 30 (Adt 32), black seeded variety gave the highest yield of 1,406

lb. while among the yellow seeded varieties, Mammoth Yellow gave 838 lb. of grain to the acre. In the same year, the above 24 varieties along with 33 new ones supplied by the Oil Seeds Specialist were tried during October in a black soil field. The results were not so good as those given by the crops sown during the south west monsoon season in the red soil area. The trial of soybean as a dry crop in red soil in July and in the black soil in October completely failed during the year for want of sufficient rains.

A more detailed work was attempted in 1937-38 (1) by sowing ten promising varieties for comparative trials in randomised blocks with 4 repetitions, (2) by testing the merits of four varieties as fodder crops and (3) by sowing 56 varieties in small areas side by side to study their comparative performances. The crop was sown in the hot weather on the 27th May 1937. It was subject to an attack of *surul* within a fortnight after sowing and the insect was controlled by spraying with calcium arsenate. This saved the crop to a great extent and it revived, but a second attack of *surul* in August almost destroyed the late varieties while the early and medium duration varieties suffered far less from this pest and yielded a fair crop. The yield figures from the comparative trials were so erratic as a result of the insect damage that no valid conclusions could be drawn. Out of the 56 varieties grown in study plots, the following four gave fair yields while the rest were far behind these in yield. Generally speaking the yields given were more an index of the severity of the damage caused by the *surul* than a true index of the normal yielding capacity of the varieties concerned. The varieties grown were classified into early, medium and late and it was found that generally speaking, the late varieties suffered from *surul* most.

No.	Variety.	Yield of grain in lb. per acre.
1.	Avoyelles	706
2.	Adt 4—Laredo	650
3.	„ 31 (Kualalumpur 16)	512½
4.	*Otatootan*	487½

Varieties for fodder. The yield figures given by the four varieties tried as fodder crops are given below from which it will be seen that Kualalumpur 30 (Adt 32) gave the highest yield of 12,800 lb. of green fodder per acre while the others were very poor. Here also, the yields were affected by the relative susceptibility of the varieties to the attack of *surul* caterpillar. Kualalumpur 30 was the most resistant to this insect.

No.	Variety.	Age of crop at cutting in days.	Yield of green fodder per acre in lb.
1.	Greenish yellow	100	3,600
2.	Lyallpur chocolate	103	2,400
3.	Adt 32 (Kualalumpur 30)	74	12,800
4.	Kachin	99	2,800

A sample of soybean fodder grown on the Central Farm was analysed by the Government Agricultural Chemist and the results of the analysis and his remarks on the fodder are given below:—

Heads of analysis	Percentage calculated on Dry laboratory sample	Percentage calculated on Original material
Moisture	8·40	72·25
Ether extractives	1·31	0·40
Crude fibre	21·87	6·63
Ash	8·32	2·52
Crude proteids	20·65	6·26
Carbohydrates (by difference)	39·45	11·94
	100·00	100·00
Acid value	57·05	57·05
Lime (CaO)	2·12	0·64
Potash (K_2O)	1·80	0·55
Phosphoric acid (P_2O_5)	0·67	0·20

Remarks: The sample of soy bean plant contains good amounts of proteins and forms a good cattle feed

The Superintendent, Central Farm has remarked that in soy bean cultivation on the Farm *surul* insect is a serious factor to deal with and to some extent, mosaic disease as well.

Agricultural Research Station, Anakapalle (rainfall 40 inches). The trials were conducted during 1936-37 and 1937-38 seasons on this station with two varieties *Pe Ngype* and *Behrum*. During 1936-37, 5-cent plots of the above two varieties were sown in June and the crops cut as fodder in October gave 10,010 lb. of fodder per acre. The plants were observed to have good root nodule formation.

A grain crop of *Pe Ngype* was grown in comparative trial plots with seed treated with a culture of root nodule organism, against untreated seed in 5 replicated plots. The treated crop developed more root nodules after flowering but the untreated plots gave a higher yield of grain than the treated plots, the average yield being 830 lbs. and 730 lb. of clean grain, respectively, per acre. A crop of *Pe Ngype* and *Behrum* sown in September of the same year was a failure due to low germinatiom and unfavourable weather conditions. During the 1937-38 season, a bulk crop of soy bean was grown in 33 cents and it recorded a yield of 679 lbs. of clean grain per acre.

Agricultural Research Station, Maruteru (rainfall 42 inches). Soy beans were tried for 3 years from 1936 onwards on this station as a dry crop. *Pe Ngype* and *Behrum* were the varieties tried. The trials were done only on small plots not exceeding 5 cents in area. During 1936-37 the crop was sown in the middle of June. Each variety was grown in two plots, one manured with 25 cartloads of cattle manure per acre and the other without the manure. The manuring had no effect on the yield of

the crop as the yield figures given below show. There was good formation of root nodules on the plants

Name of variety.	Date of sowing.	Yield in lb. per acre. Manured with 20 cartloads of cattle manure per acre.	Unmanured
Behrum.	15–6–36	1,564	1,500
Pe Ngype.	do	1,229	1,160

Trial during 'Pyru' season in wet lands. Both the varieties sown in a wetland plot towards the end of November suffered from excessive moisture in the soil and failed completely. During the 1937-38 season, the crop was raised without any manuring, again as a dry crop and it gave consistently good yields, as the figures given below show.

Name of variety.	Date of sowing.	Yield per acre in lb.
Behrum.	22–7–37.	1,900
do	17–6–38.	2,160
Pe Ngype.	22–7–37.	1,480
do	17–6–38.	1,800

Agricultural Research Station, Samalkota (rainfall 36 inches) Trials on this station were carried out during 1936-37 and 1937-38 seasons with *Pe Ngype* and *Behrum*. During 1936-37 season, sowing was done on the last day of June. *Behrum* did well and gave 1,200 lbs. of grain yield per acre while *Pe Ngype* yielded only 377 lb. Both the varieties were grown as fodder during the same season. The average yields of green fodder were 8,500 lb. from *Behrum* and 10,520 lb. from *Pe Ngype*. During 1937-38, the sowing date was delayed to 7–9–37 for both the varieties. *Behrum* failed to germinate. The field was resown to *Pe Ngype* and the latter variety yielded 1,200 lb. of grain per acre.

Agricultural Research Station, Guntur (annual rainfall 34 nches) Out of the seven varieties tried, five failed completely. *Behrum* was very poor in growth and yielded hardly any grain. *Laredo*, a black seeded variety yielded 350 lb. of grain per acre when tried in the early season and 200 lbs in the late season.

Agricultural Research Station, Palur (rainfall 51 inches). Soy bean was tried as a green manure crop on this station in wetlands in July during three years 1936 to 1938 In 1937 it completely failed while in 1936 and 1938, the green matter yielded was only 700 lb. and 800 lb. respectively. The germination of the crop was very low and the subsequent growth was also poor due to excessive moisture in the fields.

Agricultural Research Station, Aduturai (rainfall 43 inches). The trial of soy beans was started on this station in the 1932-33 season and a few of the varieties that were found promising are being grown year after year as bulk crops *Pe Ngype, Behrum* and E. B. strain 3940 (Adt. 28) are the most promising varieties in the collection so far tried.

Collection of samples. Till the end of 1939, seeds of 46 different varieties from various sources were received and grown in single rows for study. But, unfortunately several of them failed to germinate during the year of introduction itself and were thus lost. Another cause of their failure to survive was due to the ripening of the pods of early and medium duration varieties in very wet weather during the heavy North East monsoon months of October and November and the consequent difficulty of giving the seeds thorough drying necessary for retaining the viability of the seeds. The wholesale destruction of the young plants by the *surul* caterpillar is yet another cause for the loss of many of the varieties in the collection.

Seasonal trials. Trials were conducted in three seasons June to December, September to February, and December to May. June to December season has been found to be the best for growing soy bean in the wetlands of Tanjore district but unfortunately short and mid-duration varieties ripen their pods in the heavy North east monsoon months of October and November with the result that the seeds harvested during the wet weather fail to be viable in the succeeding season. More viable seeds are obtained when the sowing is delayed to the middle of August to escape the bad effects of the rains on the ripening seed. September sown crop matures in fine weather in January and the seeds obtained are quite sound though the yield is not so heavy as that of June sown crop. But as both the June and September sown crops are affected by water stagnation in the fields during the heavy rains of the North East monsoon season the crop has to be sown on raised beds 10 feet in width with drainage channels of a foot in depth between in beds and all along the boundary of the fields to draw off the excess water. If this precaution is taken the crop grows quite normally.

The December-sown crop puts on good vegetative growth in the initial stages but as it has to spend the second half of its life in hot weather and without irrigation facilities from the channels which are closed on the 31st of January, the crop fails to set seeds normally. However, a *Pe Ngype* crop grown in about 2 acres during this season gave nearly 20,000 lbs. of excellent fodder per acre, though it failed to set seed. This indicates the possibility of growing this variety of soy bean as a fodder crop in fields from which samba paddy is removed during December. Paddy varieties G. E. B. 24 Adt 8 and *Vadan samba* are generally harvested during December when grown as a *samba* crop in the Tanjore district and the fields occupied by these may be sown to soy bean for fodder.

In the absence of *surul* attack, the following average and maximum yields may be expected from the three varieties found suitable to this delta.

	Average yield per acre in lb.	Maximum yield per acre in lb.
Pe Ngype	1,200	2,000
Behrum	800	1,000
E B strain 3940 (Adt 38)	500	650

I

III

II

I. Soybean — Behrum plant with mature pods but without leaves.

II. Soybean—Pe Ngype plant with mature pods but without leaves.

III. Soybean plant showing root nodules.

In the dry lands of Tanjore, the best season for sowing the soy bean crop is with the break of the North east monsoon in September—October as a purely rainfed crop. *Pe Ngype* has been found to be the best variety for growing in dry lands during this period, yielding upto 1,500 lb. of clean grain per acre. Soy bean plants develop root nodules profusely when grown both in the dry and wet lands of Aduturai.

The soil seems to be well stocked with the root nodule organism, and artificial inoculation with the organism appears to be unnecessary. [Vide Plate].

Seeds and sowing, and cost of cultivation. The fields meant for soy beans should receive four dry ploughings to produce very fine tilth. The wetland fields should be thrown into 10 feet wide beds with channels between, to avoid water stagnation during the North East monsoon season. The crop can be either broadcast or sown in lines. When sown in rows the seeds may be spaced 1 foot in lines and 1 to 2 feet between lines depending on the growth habits of the variety concerned. Spreading types are to be given the wider and the erect types the narrower spacing. In the case of spreading types, the seed rate per acre is 6 to 10 lb. and in the case of erect types, 10 to 15 lb. depending on the size of the seeds of each variety sown. The depth of sowing should not be more than 2 inches as seeds buried deeper show poor germination.

The following figures give the average cost of cultivation for an acre of soy bean crop.

Ploughing 4 times	Rs.	5	0	0
Seed and sowing	,,	2	0	0
Hoeing and weeding twice, at 12 women per acre each time	,,	3	0	0
Harvesting and cattle threshing ...	,,	5	0	0
		15	0	0

Harvesting time. One peculiar characteristic of the soy been plant is that it sheds all its leaves by the time the pods are mature on the plant. [Vide Plate]. So it is very easy to judge the correct time for the harvest of the crop. The crop should be harvested immediately it has shed its foliage completely, as any delay beyond this would make the pods burst and scatter away the seeds.

Varietal characters. Soy bean plants may be classified into different groups according to their duration, habit of growth, character of the foliage, the shape and colour of the seeds.

Duration. 1. Short duration of 80 days 2. Medium duration of 100 to 120 days, and 3. Late duration of 140 days and over.

Habit of growth. 1. Dwarf plants with clusters of pods 2. Lean, lanky plants with zig, zig internodes with sparsely arranged pods and 3. Bushy, branching and trailing plants like horsegram.

Leaf shape. 1. Broad leaved. 2. Linear lanceolate, and 3. Ovate lanceolate.

Shape of seed. 1. Flat grains, kidney shaped, of various sizes, and 2. round grains of various sizes.

Colour of seed. 1. Pale yellow. 2. Deep yellow. 3. Chocolate. 4. Black. 5. Mottled.

Analysis of Pe Ngype. A sample of Pe Ngype grain produced on the Aduturai station was analysed by the Government Agricultural Chemist and found to contain 13 percent of oil and 40 percent proteid.

An attempt to extract soy bean oil in a *chekku* (country mill) at Aduturai by the writer and in a power crusher by the Government Soap Expert and Oil, Chemist at Calicut was a failure. Good *poonac* was obtained but no oil. Perhaps, the soy bean oil has to be extracted by the use of powerful chemical solvents.

Pests and diseases. The insects pests affecting soya beans in South India with details of the nature of the damage done and the control measures adopted as per information supplied by Sri Bramahachari, Assistant in Entomology, are given below :—

(1) **Surulpuchi.** *Stomopteryx nerteria* M. (Family Gelechiade). This is the most destructive pest of soy beans in Aduturai and Coimbatore. It may be stated that the success or failure of the crop depends more upon this insect than on any other single factor. The small caterpillars feed by mining the leaves and cause white patches After a few days the caterpillars emerge from the mines and web together small leaflets and continue to feed on the green leaf tissue. This is the same insect which appears on the groundnut crop. As the insects are attracted to light, light traps have been found to reduce pest infestation.

(2) Noctvid caterpillars (*Prodenia litura* F., *Cosmophila sp.*, *Plusia sp.*) feed on the leaves of both young and old plants; these are more serious on young plants. Spraying with calcium arsenate is found to control the pests.

(3) **Verpuchi.** *Sphenoptera pertostit* G. (Family Buprestidae). The beetle grubs bore into the lower portion of the stem and roots. The affected plants become stunted in growth and withered in appearance and ultimately dry up. This is the same insect found in groundnut, and in *daincha* and other green manure plants. Affected plants may be removed to stop the spread of the pest.

(4) In addition to the pests noted above, flea beetles (*Longitarsus sp.*) thrips, coccids, grasshoppers, and mites are found causing damage to the crop occasionally. Spraying with contact poisons was found useful against the first three insects, spraying of calcium arsenate was effective against grasshoppers, and dusting with flowers of sulphur checked the mites completely. Mosaic was noted on a few plants in some varieties each year. In one season a crop Pe Ngype was found to be attacked by a weak Fusarium fungus. This fungus, was not noted in other seasons.

Summary. From a study of the results of the trials conducted on the various Research Stations having different soil types and climates, it is found that soy beans have done best in the Godavary and the Cauvery deltas with deep alluvial soil and an annual rainfall of 40 inches or over. It was a fair success in Coimbatore in garden lands as an irrigated crop

but failed when grown as a purely rainfed crop. The crop seems to be unsuited both as a rainfed and irrigated crop in the Ceded districts. It is only a partial success in Guntur. The crop seems to be free from insect damages in Anakapalle, Maruteru and Samalkot but is subject to severe attack from insects, particularly of *surul* in Coimbatore and Tanjore districts and to mild attack in the Ceded districts.

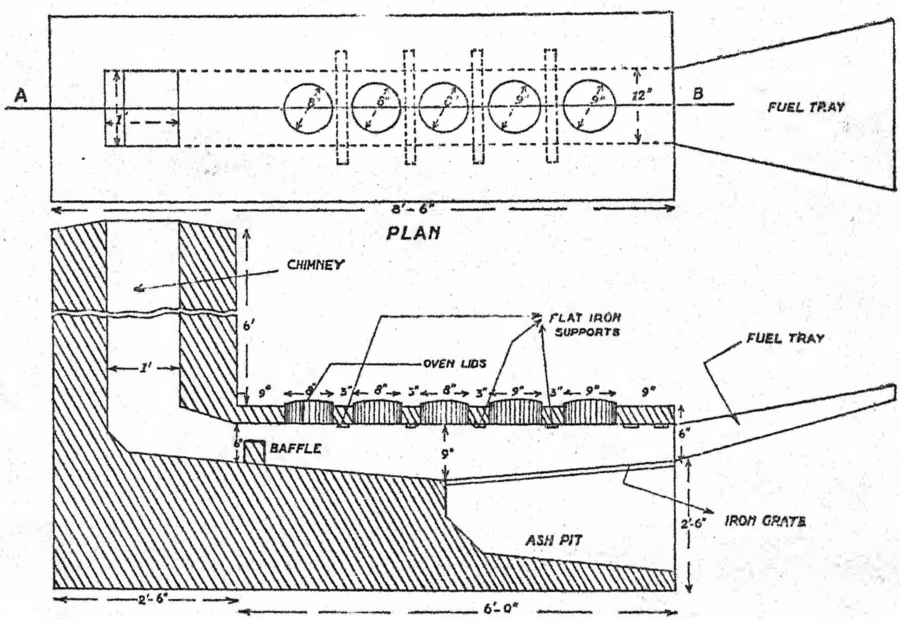
P. S. It may be mentioned that of late the enthusiasm of the people for soy bean has cooled down, in view of the opinion expressed by Dr. Aykroyd, the Director of the Nutrition Research Institute, Coonoor, that he is unable to say that soy bean is in any way superior, as a proteid food, to the ordinary pulses grown largely in India and consumed by the people.

A Hearth for the use of Groundnut Husk as Fuel.

By V. VISWANATHAN,

Assistant Agricultural Demonstrator, Arkonam.

Madras grows 3·5 million acres of groundnuts. Seventeen, out of 24 districts in the province grow over 50,000 acres. Hence groundnut husk is available in large quantities and at cheap rates in several localities. The use of groundnut husk as fuel for the household is restricted because of its poor burning qualities. But with the aid of a suitable furnace, this defect is overcome and it becomes a very convenient fuel for cooking food in the kitchen. A hearth suitable for the South Indian household has been designed on the principle of the Sindhwahi furnace that is in use for boiling cane juice and making jaggery. [Vide illustration].



SECTION

The hearth has a built-in platform 8 feet 4 inches long, 2 feet wide and $2\frac{1}{2}$ feet high. There is a twelve inch wide central flue running along the length of the hearth and is connected to a chimney 7 feet high and 12 inches square in section internally. A baffle 8" × 6" is put in near the end of the flue. The baffle could be increased or decreased in size, to reduce or increase the draught as desired The flue is covered on the top with an iron plate provided with 5 rings for taking in 5 vessels. The first two rings are nine inches and the others eight inches in diameter. The iron plate is plastered over with a three inch layer of mud. A grating one foot wide and two feet long is fixed at an incline at the flue entrance. The grating receives the husk from the feeding tray placed just over it. The tray is of galvanised iron twelve inches wide near the grating, two feet three inches at the other end and three feet long. The sides of the tray are raised and hold a fair quantity of groundnut husk. An ash pit below the grating receives the burnt ash.

A sample hearth built at Pallur, Arkonam taluk, is in use and is working very satisfactorily. The family consists of 8 members. On an average, 56 lb of wood fuel were being used by the family for cooking food previously. The new hearth now cooks food for the family—2 Madras measures of rice and proportionate quantities of *sambar*, *rasam*, dhall and a curry—in about 35 minutes using 20 lb. of groundnut husk, valued at 6 pies. A bag of husk measures 50 to 60 Madras measures ($3\frac{1}{3}$ c. ft. to 4 c. ft.) and weighs 60 to 72 lb. A bag costs one and a half annas and cooks 3 to 4 meals for the family. By the use of groundnut husk as fuel the family is now saving six annas a day—nearly 85 per cent. in the cost of fuel.

Climate and Crop Production in the Guntur Black Soils.*

A Preliminary Study.

By S. V. DURAISWAMI, B. A., B. Sc. Ag.
Agricultural Research Station, Guntur.

Introductory. The black-soil of the Guntur District is one of the most interesting tracts in this presidency and has recently come into great prominence on account of the extensive production of cigarette tobacco. This tract has long been known to be an important centre for chillies groundnut (bunch variety), cotton and cigar-tobacco. Consequent on the introduction of the Virginia tobacco and its spread, the area under the food, fodder and chilli crops has been reduced. The approximate acreage of the different crops in the two districts of Guntur and Kistna are as follows:—groundnut 6,25000, cotton 1,10,000, tobacco (virginia) 85,000, chillies 56,000. It is of a great agricultural interest that all these crops are grown under dry conditions. No other tract in this presidency or even in India, grows so many money crops with such success as can be seen from the following statement:—

* Paper read at the Agricultural Section of the Indian Science Congress held in Madras, January 1940.

Yield of Crops per acre in lbs.

Crops.	Yield average for 16 years.	Maximum yield.	Minimum yield.
First season.			
Cholam dry (fodder)	4065	7000	2225
Groundnut (pods)	1331	2400	350
Second season.			
Cholam (dry grain)	439	950	73
Chillies (dry fruits)	344	758	75
Tobacco virginia (cured leaf)	670	844	466
Cotton (kapas)	474	850	110

Dry-farming as is known to us, has its own vicissitudes and disappointments but in this tract it is of a different nature in that it is intensive and ordinarily devoid of serious failures. On the other hand the yields of crops are on a par with those of the irrigated tracts elsewhere. It is this aspect that makes the agriculture of this tract most interesting.

Geographical position. This tract lies in the curve of the peninsula on the Eastern side and near to the coast line. This aspect of the tract gives this area a specially favoured position with reference to rainfall and air movements. As we proceed westwards in this tract into the typical dry black soil of the Ceded districts, or to the South into the red soil tract of the Nellore district, such a benefit is entirely absent with the result that the only extensively grown crop is cotton. However, the precipitation in Guntur black soils during the N. E. Monsoon season is fitful and the tract is often subject to sudden cyclonic down-pours or rain may often fail. Thus the cropping in this tract is dependent more or less on the earlier rains than the later ones. The average rainfall data for 16 years (1923—1938) in 12 months is given below.

Average rain-fall data for 16 years.

Month.	Rainfall in inches (average for 16 years).	Number of rainy days (average for 16 years).	Month.	Rainfall in inches (average for 16 years).	Number of rainy days (average for 16 years).
January	0·01	·06	July	5·81	11·5
February	1·12	1·4	August	5·26	10·0
March	0·16	0·38	September	6·28	9 6
April	0·75	1·5	October	5·62	6·6
May	2·14	2·4	November	3 20	4 0
June	3·54	6·5	December	0·90	0·4

Nature of the soil. The soil is a heavy clay containing about 30 per cent of clay and 30 per cent of fine silt. It is over six feet deep in some places and can be said to be the best black soil of the Presidency. Its retentive power for moisture is very great and this accounts mostly for the very successful cultivation of the various commercial crops. The analysis of the soil done by the Agricultural Chemist, Coimbatore in 1923, when the station was newly brought under cultivation is given below ;—

Loss on ignition	7·100
Insoluble mineral matter	68·060
Iron (Fe_2O_3)	6·787
Aluminium (Al_2O_3)	11.174
Lime (CaO)	2·590
Magnesia (MgO)	2·380
Phosphoric acid (P_2O_5)	0·039
Potash	0·543
Soda	0·619
Sulphuric acid	0·036
Carbonic acid	1·093
Nitrogen	0·0550
Available phos. acid	0·0039
" potash	0·0166

Moisture	8·19
Fine gravel	5·14
Coarse sand	2·74
Fine sand	11·30
Silt	11·93
Fine silt	30·06
Clay	29·01

The analysis shows a deficiency in phosphoric acid and nitrogen which is generally made up by systematic application of cattle manure and the mixed cropping that is practised under normal conditions. It is generally well supplied with lime and potash.

During summer the temperature goes well beyond 110°F. and the soil cracks deep. The inherent fertility is kept up and does not seem to have been affected even in places where, due to economic reasons, rotation of cropping has not been kept up. It is an almost ideal soil which retains moisture to the greatest extent, allows free drainage and when kept under good tilth becomes fit for sowing or cultivation within an astonishingly short time even after very heavy showers. In 1938 except for an abnormally heavy rainfall of 20" in August-September, there were no further rains still the second season crops were grown successfully with the rain recieved in August-September. Such is the retentive capacity of this soil.

Season and rainfall. The year in this tract may be classified into (a) the summer months (from February to May), (b) South-west monsoon or '*Punasa*' season (from June to September), and (c) the North-east monsoon or the '*Pyru*' season (from October to January). The *Punasa* is suited for fodder, groundnut and minor food crops and the *Pyru* for tobacco, cotton, chillies and millets. The period from January to March is cool, dry and practically rainless. It therefore aids the ripening, harvesting, and preparation of the produce for storage or sale. In general, once the rains start in June or July, the precipitation continues at intervals upto about October, so that the crops in that season get the supply in adequate quantities and the fields intended for the second season crops are cultivated several times when conditions permit and are thereby enabled to absorb and retain the maximum amount of moisture necessary for the benefit of the second season crops.

Cropping system. A very good system of rotation of crops to meet the various needs of the farmer is practised *viz.*, in the first season a pure fodder crop or groundnut (a cash crop) and in the second season cash crops (tobacco and chillies) and grain crops for food and fodder. The following system of rotation of cropping is followed under normal conditions and has proved to be the best for the tract:- First year—chillies;

second year—ground nut or maize or late grain cholam; third year—tobacco or fodder crop, or first year—fodder cholam; second year—chillies; maize or variga; third year—tobacco; fourth year—ground nut.

Yield and its correlation with rainfall. It has been pointed out that the successful cultivation of crops under dry conditions, elsewhere grown in garden-lands, is mainly due to the adequate and well distributed rainfall. On correlating the rainfall with the yield of the more important crops the following interesting features were brought out:- (1) It is the distribution and not the total rainfall that counts. In 1929, the rainfall was the lowest yet the yields were favourable, probably due to the good distribution of the precipitation. (2) In years when the average has been exceeded due generally to sudden down-pours or cyclones the crops have been adversely affected and pests and diseases have increased. (3) A rainfall less than average does not necessarily reduce the yield. (4) Years-succeeding those with rainfall in excess of the average have given better yields. (5) A favourable first season is an almost sufficient warrant for a fairly successful second season. (6) More than average rainfall is not at all necessary for tobacco and cotton.

Climatic influences. Though the rainfall is the main factor there are other influences which affect the cropping of this tract. The rainy days should alternate with clear days and when this happens an astonishingly rapid growth in the crops is seen. During these months there are frequent thunder-storms which probably help in the growth by way of electrical influences. Alternating dry periods are essential for the inter-cultural operations which have a very good effect on the crops. The tract is subjected to sudden down-pours (as much as 10 inches in 11 days) yet the soil is not subjected to serious wash as the land is not undulating and a well-cultivated soil absorbs surprisingly large quantities of moisture. Such heavy rains however, give rise to much surface surplus flow and the system of storing the surplus water in ponds adjacent to the fields is an interesting arrangement, in that the ponds retain water for a long time and enable the farmers to sow and water their chilli and tobacco nurseries and subsequently to water the transplanted crops. The dry weather period succeeding the North-East monsoon season is of great importance for the maturing and successful harvest of the money crops. A steady sea-breeze starts from about the end of December which is believed to help the rapid growth and maturity of all the second season crops. The temperature variations between night and day during the first season are very little, the average minimum ranging about 80° and the average maximum about 90°F. The first season crops therefore, have generally, very favourable temperature conditions for their growth.

Forecasting and how it can help. A tract which is so greatly dependent upon climatic influences should naturally benefit very much by a systematic study of the climatological manifestations and the part they play on the crop production. If it were only possible to forecast the nature of the first

season, its rainfall and distribution, the ryots would be in a position to adjust their cropping definitely with reference to their needs of food, fodder and cash. It has been found by experience that when there are reports of heavy rainfall in the West and North-West as in Mahabaleswar and Nagpur adequate rainfall can be expected in this tract immediately after. In the same way when there is heavy fall recorded at Masulipatam and Cocanada there is sure possibility of rains in this tract. The early or late start of the season has its own bearings on the situation since an early one facilitates the raising of two crops. The raising ot nurseries can be adjusted so that the crops are planted at the right time. Sometimes heavy rains are received in February and March. An indication of these in advance should give the cultivator a chance to manipulate his harvest and curing of the tobacco in such a way as to incur minimum loss. It is therefore, not out of place to emphasise here the necessity for starting meterological sub-stations in such important tracts.

Conclusion. In conclusion, it may be said that this tract enjoys a more favourable condition of weather and rainfall than other dry-land tracts. Yet it is left to us to use our ingenuity to extract the maximum benefit out of the indulgence of nature. We have to make efforts to keep the soil in its right condition, sow the best and give the best of our attention so that the normal out-turn is assured invariably. Any complicated or elaborate system of manuring is out of the question particularly with artificials. Systematic and adequate manuring with organic manures like cattle manure, sheep manure or cake and bones have given the best results. Crop improvement work in such a tract should proceed on the following lines:—Crops should be bred to (1) withstand heavy rainfall and long drought; (2) give immunity or resistance to diseases and insect pests; (3) come into maturity at suitable seasons (4) conform to the quality required in the markets and (5) give adequate yields to make their cultivation pay a handsome return.

Seed Testing.

An important Agricultural Practice.

By S. N. CHANDRASEKARA AYYAR, M. A.,

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Introduction. What is it that every gardener or farmer would most desire? The ready answer to this question will doubtless be one word 'success'. Success in good farming or gardening will mean the production of the largest, the handsomest, the healthiest and the most vigorously growing plants yielding the maximum produce which will give an abundant return for the labour and expense of running a farm or a garden. For, 'a product properly produced is already more than half marketed'. The first and the foremost criterion is the purity of the seed for its species and the strain or variety the farmer which intends to grow. For example, if it is to be Co_2 Combodia, he must make sure that it is Co_2 Cambodia and nothing

else, for it is a very common thing to find inferior cotton seeds like those of *Pulichai* mixed up with this. The next point to be considered is that the seed should be free from other crop seeds. A sample of cotton may contain seeds of *tenai.* A third point to be noted is it should be free of weed seeds and in this connection no amount of emphasis can be laid on its freedom from seeds of weeds of a parasitic nature such as those of *Striga, Orobanche, Cuscuta,* etc. Another point for consideration is that the seed sample should be free from mechanical impurities such as mud, bracts, bracteoles, etc. The most important point, however, is that every seed sown should sprout and grow into a healthy plant. There should be absolutely no gaps in the field. Success in farming, therefore, centres to a great extent round the seed. The farmer must see that the seeds he consigns to earth are endowed with a maximum power of life. If one wants a hundred per cent result one must plant seeds that rate 100 in the scale of life in a soil that rates 100 in the scale of fertility.

In order to know the true value of seeds that one is going to sow, one must test them for their vitality. This is known as "seed testing." Since 1930 this work is being done by the Lecturer in Botany, Agricultural College, Coimbatore, for the department and the public on scientific lines and so far more than 1,200 samples of seeds of different kinds have been tested. Samples of seeds have been received as for example from the cultivated cereals, pulses, oil-seeds, the green-manure crops such as sunnhemp, *dhaincha, (Sesbania aculeata) kolinji (Tephrosia purpurea) pillipesara (Phaseolus trilobus),* cotton, tobacco, tea etc.

Methods of testing. One would certainly be interested to know how seed testing is done. In the laboratory seed testing is done in what are called "germination trays" which are made of zinc sheets and the test is carried on in the incubator under a constant temperature. The tray measures 6" x 6" and is 2" deep with perforations on all the sides for aeration. Inverted into the tray is a framework of wire gauze across which are laid two strips of filter paper cross-wise, so that these touch the bottom of the tray where water is kept. Over this framework a square piece of filter paper with hundred square rules on it is placed. This is kept constantly moist by the connecting strips of filter paper, placed cross-wise. Since the tray is kept in an incubator, there is no need to cover the tray with a lid. But, if the test is carried outside the incubator, the tray has to be covered with the lid. So all the ideal condition for germination are here, i. e., moisture, air, constant temperature and darkness. Ordinary seeds like paddy, sorghum, etc., are sown on wet filter paper after giving the seeds a previous soaking in water overnight. Hundred squares are ruled on the filter paper and countings are taken from day to day till the whole set finishes its germination. Seeds like cotton or tea are sown in moist sand in trays. Holes are made in the sand and the seeds are dibbled into them and here also each tray carries hundred seeds. It is quite easy for even a layman to practise seed testing. Supposing a farmer wants to test his seed paddy before purchase, he should

get samples from 3 or 4 different merchants, taking care to obtain random samples from the different portions of the seed containers of each of these merchants. Two hundred seeds should be counted out from each sample irrespective of their size, shape, appearance, colour, etc. These should be sown in duplicate in clean moist sand in shallow earthernware pots provided with drain holes and labelled. One hundred seeds should be arranged in each pot in 10 rows, each row carrying 10 seeds. Separate counts should be taken of the germinated seeds from day to day for about a week and recorded. In this manner the total germinating capacity of each of these samples is determined. By doing so, not only the germination capacity of each sample is easily determined but the speed or energy of germination is also noted. If a sample shows 90 per cent germination in five days and another the same percentage in ten days it is obvious the former is a better lot than the latter.

Observations in this laboratory go to show that the germination speed is generally very high in almost all our cultivated crops provided the seeds are of good quality. Ordinarily even at the first counting which is done 24 hours after sowing, a good lot generally records as much as 70 to 80 and very often the test is completed on the third day. Counts are taken of seeds where the radicle (the primary root) is seen emerging out. These are the healthy seeds which are said to be germinating. It is very infrequently that there is need to carry on the counts to the fourth day. In poor lots, however, one has to wait up to 10 days. There are also slow germinating seeds such as tea, sugarcane, onion and kolinji, which need a longer period. In the case of *kolinji* the slow germination is due to its hard coat. In cases where seeds are hard coated as in many of the Leguminosae and in seeds with hairs as in cotton it is recommended that for hastening germination the seeds should be specially treated. In the case of cotton, the treatment usually adopted is stirring the seed with concentrated sulphuric acid for about 3 to 5 minutes, filtering the acid and throwing the seed into rain water. The acid treatment chars the fuzz of hairs which are easily washed off in water. This process of delinting does not interfere with germination in any manner. In the case of *kolinji* two methods have been tried viz., (1) the treatment with concentrated sulphuric acid, and (2) rubbing the seeds with glass paper by hand. The latter method has always given better results and is the only method that is now adopted. Tea seeds which are hard coated and have low viability are treated like *kolinji* with glass paper. They germinate very satisfactorily giving us an increase of about 20 per cent over the untreated seeds. Another method advocated is, to steep the seed in boiling water for five minutes dry and then sow. It is explained that the hardness of the seed coat in seeds like *kolinji* serve a purpose. In adverse conditions the ordinary seeds are destroyed but hard seeds survive the period and propagate the species when favourable conditions set in and therefore it has been argued that hard seeds should be regarded as germinable for purposes of declaring the percentage of

germination capacity of a sample. Under the rules of the International Seed Testing Association a compromise is adopted. One half of the hard seeds is added to the number germinated for calculating the real value of the sample. At the end of each test, the total number germinated, the number attacked by mold and the number of hard seeds are also given.

Conclusion. In a vital matter like purchase of seed the farmer looks for qualities such as colour, size, lustre, plumpness and sometimes smell as in coriander, paddy, etc. No doubt, these are points worthy of consideration, but appearance is very often misleading and what is really wanted in addition to good appearance is a good performance when they germinate, for 'handsome is that handsome does'. So seed testing on scientific lines is very essential. Seed testing has been going on in the Western countries for more than half a century and two of the world's greatest seed testing stations are at Zurich in Switzerland and Copenhagen in Denmark. Very valuable research work in seed testing has been done at both these stations. There are seed testing stations established now in the United States of America, Great Britain, Ireland, Australia, etc.—in fact in almost all the civilised countries of the world.

This is an age of commercial competition and if the Indian farmer is to be progressive he must eliminate every element of chance in agricultural practice so as to strengthen his position in the universal struggle. Though a creature of habits and very conservative by nature, the Indian farmer must realise the present day conditions and rise up to the occasion. It is said that agriculture was a fairly easy task a hundred years ago when seasons were more normal, prices of seeds and other commodities low and labour much less expensive than now. The state of affairs is entirely different to-day. The Indian farmer must copy the farmer of the Western countries and adopt scientific methods and see that he reaps the maximum profit from his labours. One of the most important considerations should be that his seeds are pure both for the species and the strain or variety which he intends to grow, and free from impurities such as chaff, mud, weed seeds and insect or fungus attacked seeds or plant parts and also show a high percentage of germination and vigour. Hence the motto should be never to sow seeds without testing them for their vitality and purity.

SELECTED ARTICLE

America's New Deal in Agriculture.

By J. K. TAYLOR, M. Sc., B. A.,

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In 1929, things began definitely to go amiss with the American farmer. Since the World War, 1914—18, agriculture has been existing in a state of fluctuating prosperity, trying to keep pace with the crazy finance of the industrial world in America. The policy of high tariffs, high prices, and heavy over-production, combined with a shrinking overseas market, brought the economic depression in its train, and the first man to feel the effects was the farmer. The first reaction was to put into practice the idea that the way to pay bills was to produce

more—producing more meant flogging the land or using more machinery for large scale cheaper production. To pay for machinery, constant cropping was necessary, and that meant more goods to sell on an overfull market at low prices. When prices are low the 'grow more-sell more' principle merely puts the farmer more hopelessly into debt. In additiun the fertility of the soil decreased and erosion played havoc with the land It was brought out in 1932 that a farmer's income was only half that of 1914. This was due to the fact that while the farmer paid 9 per cent. more for the same goods, he sold his own produce for 43 per cent. less than in 1914. Continuance of this state was impossible, and before remedial measures were instituted there had been a serious decline in the prosperity of the farmer, often to subsistence levels, accompanied by a no less serious degeneration of the soil.

A great deal has been said about the 'New Deal' of President Roosevelt, often loosely and without a clear understanding of the idea behind it. Americans themselves are highly critical of it but as far as could be gathered last year, they have small idea of what to put in its place. At any rate in these days, they, and we also, cannot afford to be negative. What is this New Deal in Agriculture? It may be summed up very briefly—stability and security: a policy of save the farmer and save the soil. The American farmers are a most independent and individualistic people; it is part of their creed to stand by the idea of a God-given right to plough their own furrow. They have clung to their right of possession of their land up to the stage of dispossession and then moved to new fields exactly as the "Okies" migrated westward into California and the Dakotans into Oregon and Washington in the last five years. But the New Deal has given a plan to keep farmers from moving and even if it guarantees only a subsistence level of life, it has the merit of security. There has grown a spirit of co-operation, of community endeavour which overrides independence and makes the group plan and helps its individual members. President Roosevelt has been interested, personally, in farming all his life and understands the farmers' position. No other leader seems to have grasped the problem so well or tried to do so much. What failure there is, is not due to the *spirit* of the New Deal whatever the criticism of its action.

The history of American farming in the past ten years has been disastrous but the decline from as far back as 1920 has been severe. There are 6½ million farm families in the U. S. A., forming 22 per cent. of the population. In 1920, they received 15 per cent. of the total national income—in 1925, 11 per cent. in 1928, 9 per cent., and 1932, 7 per cent; since 1932 most of the mass migrations have occurred which forced the nation to take an active part in stabilising the agricultural industry. There was pressure on land in some places when the closing factory doors sent jobless sons to their father's farm and in other places, the land was abandoned. Last year the Texas and Oklahoma panhandles, and the adjoining parts of Kansas and Colorado which form the very heart of the famous "Dustbowl", presented a very un-spring-like picture in April. In driving 50 miles through the Oklahoma panhandle into Kansas and into south Western Colorado, there was not one mile of green to be seen. Odd patches of sprouting wheat and some of the ubiquitous roly poly did not relieve the grey and brown landscape of windblown soils and dead grass. Drifting soil had shaved off the grass and young wheat plants and piled itself in hummocks and along fence rows. The resident owners had walked off, absentee landlords had given up the task and the mortgagees from New York to San Francisco were waiting for the promise of a good year or high prices to return. At this time 300,000 migrants from degenerated lands west of the Mississippi were moving with the tide of employment hopelessly up and down California, while Oregon and Washington tried to absorb the human stream for Motana, the Dakotas and

Nebraska. Through Tennessee and the southern States there was poor living for the farmers and an increase in tenancy and share cropping. The average farm income in Alabama in 1938 was about 500 dollars, as compared with 2,500 dollars in Iowa as the most prosperous State in the Union.

The story of land misuse and erosion painted so vividly by the publicity men in the Department of agriculture of the southern part of the country did not need exaggeration. Travelling in 1939, through these south-eastern States gave the impression that commonly the farmers were far from secure. At the last census in 1930, 42 per cent. of all the farmers in the U. S. were tenants who farmed 43 per cent. of the total farm acreage. The principle of tenancy is recognised as being against good farming. No farmer values someone else's land as his own. Much of the tenancy is found in the south and the west-central States so severely hit by drought and pests.

With this sketchy background it may be possible to visualise something of the urgency and the reason for the force of the New Deal campaign for stability and security of the farmer. From 1933 onward, since President Roosevelt came to power, there has been a series of acts passed by Congress aimed at improving agricultural conditions These cannot all be mentioned, but some are highly useful examples for us to study. The new Deal policy had three main aims. (i) Reorganisation of the Department of Agriculture. (2) Policy of planned land use. (3) Reduction of farm taxation and prevention of mortgage foreclosure.

In the fulfilment of these plans a great many new duties were given to the Department of Agriculture, for which provision of staff and finance was made, but as the new agencies multipled there arose some confusion of effort and conflict as to the scope of work. In 1938. the Bureau of agricultural Economics was given the job of planning a programme of investigation and assistance, and an office of Land Use Co-ordination created for the purpose of co-ordinating the work of the various sections of the Department in their approach and service to the farmer. This is the body which carries the second item in the programme-planned land use.

Planning land use really developed from two angles. First the policy of land improvement sponsored by the Agricultural Adjustment Administration—the A. A. A. or Triple A.—and secondly, the activity of the Soil Conservation Service in stabilising land against erosion. The main function of the A A. A. was the limiting of the production of primary products in accordance with the market's demands. Briefly, the Bureau of Agricultural Economics undertakes the work of predicting market requirements in advance and assessing a figure for total U. S. production of certain crops and livestock in the current year. The main crops affected are wheat and cotton—this year tobacco will probably be important also. The A. A. A. then portions out the area for each State concerned with the crop, and it is possible for it to swing production gradually from one part of the country to another on the grounds of greater suitability of climate or superior quality of product. This can only be done by degrees to avoid the shock to local industry, but the aim is good, namely to concentrate production in the most suitable belts and build up compensating industries in those parts deprived of a staple crop. Each State distributes its quota according to counties and the county deals with the limiting of its own crops according to its allotment. Up to 1935, the payment made by the Federal Government to compensate farmers for the smaller area planted was taken from a tax on processed primary products such as flour, but on this tax being declared unconsitutional by the U. S. Supreme Court, the later payments have been met from general revenue. There was one change made in policy—the farmer was given a contract with wider obligations. If the taxpayer at large had to pay the farmer, he was entitled to demand a return for his money ; since the land is a national asset and therefore

everybody's concern, a return could be made by the farmer improving his land as a national asset. The farmer was required to restrict his crop and to plant or treat the land thereby not used in a manner prescribed by federal agents. He had then three alternatives. He could perform the full contract of restriction and prescribed management and be paid for it. He could restrict his crop without carrying out any soil building programme, in which case he would not be paid; or he could neither, in which case he would be penalised by the confiscation of the excess crop. The first course is naturally adopted by the main body of farmers. The point to be noted is that a string is tied to the contract and the ultimate aim is not only to control the market supply of the crops but to institute a programme of land improvement-whether it be by prevention of erosion by the use of legumes or pasture for raising fertility, or by the retirement of unsuitable areas to farm " wood lots "

The second agency in land use planning is the Soil Conservation Service. The Service was set up in 1936 specifically to tackle the problem of soil erosion and conservation nationally, and in a manner not possible for all individual states. It has worked by advice and active assistance in farm planning, but in particular through soil conservation districts set up, with an advisory staff, at the voluntary request of the farmers of the district. The soil conservation district was organised with a manager and a variety of assistants trained in agronomy, engineering, forestry etc., according to the nature of the area. The object was to reclaim degenerated portions of the district and make an attack on problems of farm management as they affected soils, stabilisation and crop improvement. The soil conservation district permitted soil erosion control to be instituted on a wide scale, with the aid of demonstrations and experiments and the organisation of the whole community on the basis of planned agriculture.

Whatever was done for advancing the farmer and raising his income, equally assisted in keeping him from moving. Security of farm ownership meant a great deal to a farmer in constant fear of a succession of adverse years, mortgages and possible foreclosure, of being forced into tenancy or finally into share cropping. The evidence seems to show that this was no unusual condition, and a very great problem in many States. There was a way out. The land could be improved in production and rendered secure by development along sound lines made possible partly by A. A. A. payments and partly by loans made through the Farm Security Administration. The latter agency was set up in 1937, for the specific purpose of financing farmers with a genuine case for assistance. The loans are of three types. First, good farmers who have lost their land or are on submarginal land incapable of returning them a living may be lent money to re-establish themselves on a fertile site. There is a requirement that the new farm be handled correctly, and Federal officers have the job of watching the development. Second, farmers might receive loan to allow them to get on their feet again, provided they followed intelligent farm management plans. These loans are on a five-year to ten year basis at low interest. They were used for buying livestock, implements, fertilisers, and such things that a low income would not allow for effecting improvements. Third, tenant farmers may be assisted by long term low interest loans to buy farms for themselves. For five years after purchase, the Government may resume the farm if it is not used properly, and throughout the period of the loan Federal officers may supervise farming operations.

Another Act passed by Congress authorised the purchase of submarginal land to remove it completely from the market and develop a better use for it. This land is being taken out of poor farms into range grazing land, forests, recreation areas, or other suitable uses. The amounts of money voted for this and the loans to tenant and other farmers are small by comparison with the need. There are 86 million acres of submarginal land in farms, and only 50 million dollars were

voted to begin buying it. The numbers of tenant farmers were increasing between 1880 and 1935 at the rate of 33,000 per year; the 50 million dollars in 1939, the largest amount voted for assisting tenant farmers, would not nearly cope with the annual increase if all were to be re-established as landholders. Obviously a proportion would not be worth financing even on supervised farms.

Of all the efforts at improvement, none are more interesting than the community planning sponsored by the land use planning agency of the Bureau of Agricultural Economics. Despite the independent attitude of the farmer, there has come a strong movement towards co-operation and in at least one county in every State communities have elected committees to study and plan for the improvement of the district. The committee is essentially made up of farmers with some State or Federal agents acting as advisers. Their object is to work out a scheme for lifting the level of the community, for example by proposing on the agricultural side a more extensive use of fertilisers, or an increase in the number of high-class bulls, and on the social side, a new road or moving a school site or a rural electrification scheme, or the provision of a recreation reserve. The committee formulates the programme of improvement they would like for the community and, to implement it, may ask for assistance by money loan, cheap electric supply, fertilisers at low rates, or perhaps labour to be done by a Civilian Conservation Crops youths' camp. The community scheme is passed on by the State planning committee, if they are agreeable to Washington, where it may be accepted or referred back for amendment. The Government both State and Federal, is keen to help these community committees because the security and stability of the rural population is one of the most urgent problems to be faced. Last year 450 counties had begun community planning within eighteen months of the inception of the movement by the Department of Agriculture so that the future progress of the scheme will be very interesting to follow.

The account given of the activities of Federal agencies set up as a part of the New Deal policy has been necessarily sketchy and there are many other aspects which could be discussed. For example, there is the Tennessee Valley Authority's programme of development and rehabilitation in that area touching on seven States, all of which are co-operating. The co-operation of State and Federal research and extension services is a most pleasing sign; it is a recognition that the brains, as well as money, of the Federal Department can be used to solve national problems within individual states. A Federal Crop Insurance Act, 1938 attempts to insure crop returns to the farmer. The Surplus Commodities Act, 1937–8 provides money for buying crops in excess of the estimated production to prevent gluts and low prices. The Omnibus Flood Control Act, 1936-8 seeks to co-ordinate Federal Government attack on flood problems by bringing in the Department of Agriculture to work with army engineers; it was the the first sensible step in flood control in so far as the problem was tackled at its source in run-off control though land management instead of by building bigger and better levees as in the past. A Water Facilities Act of 1937 provides money for developing water resources in arid and semi-arid regions according to an approved land use programme. From various sources the Secretary of Agriculture is given emergency relief money to preserve wild life, forests, soil, and to control insect pests.

There are a great many critics within and without America of this vast planning programme and public expenditure. Foreign observers often have not quite grasped the size of the country and the extremely serious state it was in. It is all very well to say there is "graft" and misuse of money, that the country cannot go on indefinitely assisting farmers, that the administration does not know where it is heading or when to stop, and that the whole organisation is a

pretty example of triumphant and bungling bureaucracy. In the foregoing pages the principle aims and some of the methods of the New Deal have been described, and undoubtedly good is being done. Some "dictators" have made the statement, somewhat cold-bloodedly, that as the western Dakotas and Nebraska and much of the Dustbowl constitute only range land and have been broken up for wheat by mistake, that they should just simply revert to grass and the quicker the better. Unfortunately such wholesale programmes are impossible because population cannot be moved *en bloc*, Much of the Texas panhandle is held in 320—acre or smaller areas, and the average carrying capacity or range land is 10 or, on good land may be 20 beasts per square mile. What then is to be done with say 100,000 farm families who would pass out with the return of the range. Resettle them? And if so, where? Or send them into the towns, and as surely on to relief? The projected plan for the Dustbowl reduces wheat acreage from 19 million to 13 million acres and proportionately alters all other crops while putting the remainder into grass. Ultimately the agricultural system will find its proper balance. It cannot be indefinitely supported by government grants, payments and loans, but if these had not been used in the past five years the critics would have had much more reason to deplore the continuance of the Old Deal. In any case, at least one traveller last year in America found the critics without a plan to substitute.

Surely the way to view the New Deal is as an attempt to save the farmer and the land by the only means that seemed adequate in the desperate condition affairs were reaching in 1934; namely by a huge expenditure of public revenue and loan money. The eyes of the nation are tending to focus on control of land use by Federal or State or other bodies. The people are learning no longer to permit the use of unsuitable and submarginal land in small holdings and in rural communities the spirit of co-operation to improve farms, incomes and living in general is stirring. There are many things the farmer can thank the New Deal for, and perhaps the salvation of the farmer in the long view may transcend the mistakes and cost of the great experiment. Australia has not the same problem to face, but there is every need for land use planning and sound development of a *permanent* agriculture. Eyes on America therefore for experience, with a tolerant discriminating judgment. (*Journal of the Australian Institute of Agricultural Science* 6: (1940) 78—84.)

ABSTRACTS.

Cold Resistant Sugar Cane. Queensland Agri. Jour. 53: (1940). An experiment is now being carried out in the United States in the division of sugar plant investigations. The variety in question was received from Turkestan, and during the past three years several further importations of the same type of cane have been made. It is quite probable that there are many such varieties of wild cane in the vast stretch of country between the Caspian Sea and Western China, but the difficulties of travel in such remote parts have prevented visits by plant explorers. The outstanding characteristic of this "Turkestan" cane—is its ability to withstand extreme cold. The first importation was grown in the vicinity of Washington, U. S. A. at a latitude similar to that of Tasmania. During winter in spite of the fact 15 to 20 degrees of frost were registered, the plants remained green and few of the lateral buds were killed. The cane was also found to grow quite rapidly under the comparatively cold conditions of spring. Sugar-cane in Louisiana suffers from the extreme disability of late autumn frosts so that it has to be harvested before it is ripe, while early spring frosts prevent its early planting or ratooning, so that the cane has a growing season of only some seven or eight months per year. Dr. Brandes and his associates have tried to hybridize

this cold-resistant cane with some of the local canes in order to produce a commercial cane with a longer growing season. A difficulty arose in that the Turkestan specimen arrowed in mid-summer, whereas the commercial varieties of sugar cane arrow in late autumn. This was overcome by taking advantage of the reversal of seasons North and South of the equator. Enquiries showed that commercial varieties of cane would be arrowing in the Republic of Columbia, in South America, at a time when the Turkestan cane was arrowing in the northern hemisphere. Cuttings of the Turkestan cane were planted in boxes and when the arrows were just about to emerge they were carted and shipped down to Columbia as fast as possible. When removed from the crates the arrows were in good condition and they were then set in position in contact with arrows of commercial varieties of sugar cane. At the same time pollen was collected in special containers from the cane which was arrowing in Washington, and these containers were then rushed by aeroplane to Columbia and there the pollen was dusted on to the flowers of commercial canes. Both methods proved successful in 1938 and some 15,000 hybrid seeds were obtained and taken back to Washington by air. The seeds were planted immediately on arrival and gave rise to a large number of seedlings which are obviously hybrids between the two types of cane. They have shown improved vigour over the wild type and have also demonstrated their ability to withstand cold which would have killed ordinary varieties of cane. In 1939 further pollen was sent to Columbia and hybrids were again obtained. Also the pollen from the 1938 hybrids was back-crossed with the commercial types The progenies of these are grown at Washington—these having one quarter Turkestan blood. This success does not necessarily imply that the sugar industry will be shifted to colder climates but that considerable benefit would be conferred on some of the sub-tropical cane-producing countries. It is also realised that the necessity to ennoble the hybrids in order to improve the sugar content and tonnage, will lead to the ultimate dilution of the cold-resistant properties of the hybrids. Nevertheless it will be a very great achievement if there can be produced an otherwise suitable cane which will be able to withstand temperatures of, say. 28°F. instead of being killed at 32°F. and perhaps this is as much as could be expected.—N. K.

Problems of keeping milk in the home. O. Kudelka, *Queensland Agr. Jou.* 53:. (1940).

A high-quality milk for drinking purposes has to satisfy several conditions. It has to be fresh and free from pathogenic germs. It has to contain as few as possible milk bacteria which are not pathogenic, and has to possess all nutritional properties in good proportions. In short, a high-quality milk has to be clean, safe, and rich. To produce, handle, transport, and to sell such a product certain methods must be applied. Among conditions for the production of a high-quality milk the temperature plays a very important part. The amount of bacteria present in freshly drawn milk coming from a healthy cow is always very low The increase in the bacteria in the milk is caused by two factors. Firstly, external contamination that occurs during the handling with unsterilized utensils, or by dust contamination; and, secondly, the multiplication of the original milk bacteria at a favourable temperature, and time. The medium of milk is one of the best, and is very suitable for the multiplication of the milk bacteria and the bacteria commonly coming from the external sources The most favourable temperature for this development is over 70° F. and the optimal temperature being between 70° and 90° F. Hence the importance of the cooling of the milk immediately after milking to keep its original low bacteria count and the need for strictest cleanliness in handling. The number of bacteria increases proportionately to the length of time the milk is stored. This multiplication, however, is limited since the development of

bacteria is checked by the by-products of the bacteria themselves if they are present in too high numbers. Even after its supply to the household, milk must be treated very carefully. It has to be kept in the cleanest utensils (best in the bottle it is delivered in), and placed in a very cool spot. It is better to have a small quantity delivered twice a day than a large quantity once a day. The bacterial changes taking place in the milk at various periods of time and temperatures were tested. Six bottles of fresh pasteurised milk were examined. The first bottle was counted for bacteria immediately on arrival while the sixth was kept in a refrigerator. The remaining four were kept at atmospheric temperature and counted at different times. It was found that bottle 1, gave 12,000 bacterial count at 8·30 a. m. the time of arrival, while bottle 5, at 4 30 p. m. gave 2,960.000. The sixth one kept in the refrigerator (56·0°) gave 2,900 at 5 p. m. The argument that pasteurised milk loses some of its supposed forces of resistance was found to be unfounded. Experiments have proved that milk, if it is properly pasteurised, does not lose any of the good qualities of the raw milk, but is freed from all pathogenic germs that could be present in it. Experiments similar to those of the pasteurised milk conducted with clean raw milk showed that at the end of eight hours at room temperature the count of bacteria was the same as in the previous set of experiments while that kept in the refrigerator gave after eight hours 14.000. Both experiments seem to prove the importance of cold storage of milk, even at home, and stress that the time of storage should be limited unless at a temperature below 60°F. The higher the temperature the shorter the time of storage should be. N. K.

The influences of sowing depth and moisture on smut diseases and the prospects of a new method of control. G. H. Jones and A. G. Seijel Nasr. *Ann. App. Bio.* 27·35--57, 1940.

In Egypt wheat and barley are planted in two ways, the chief difference being that in one case (*herati*) the soil is moist and the seeds are planted deeper while in the other (*afir*) the soil is wet and the seeds are nearer the surface. Bereal smuts were found to be sensitive to the method of planting and *herti* sown plots showed consistently a higher percentage of disease. This led to the conduct experiments to note the effect of methods of planting on smut diseases. Studies were made on covered smut of barley (*Ustilago hordei*) grain smut of millet and broom corn (*Sphacelotheca sorghi*) bunt of wheat (*Tilletia tritici*) and flag-smut of wheat (*Urocystis tritici*). The two systems of planting were followed and sowings were made at 5 cm. 4 cm. 8 cm. and 12 cm. from the surface. The *herati* plots had 25 per cent moisture content and *afir* plots 32 per cent. Thus two factors sowing depths and soil moisture were involved in these experiments. The results showed a progressive increase of disease with each increase of depth with a few exceptions all occuring in deeper plantings in wet soil. Depth of sowing is found to have a marked influence on the incidence of smut and this is due to the lengthening of the susceptible stage of the host by deeper planting. The rupture of the coleoptile and the consequent onset of resistance of the seedling are delayed. The influence of soil moisture is less and constant wet soil discouraging disease increasingly with depth, presumably due to lack of aeration. The exceptional cases in deeper plantings in wet soil are explained by stating that the fungus becomes destructively parasitic killing the weak seedings at an early stage and thus preventing a proportion of infected seedlings developing into diseased plants in the crop. In countries where irrigation is practised and where it is possible to control soil moisture and depth of sowing, smut diseases can be checked by planting as shallow and on as wet a soil as possible. In Egypt flag-smut of wheat which is both soil and seed borne can be more efficiently controlled by "mud sowing method" (moist soil ploughed and flooded and seed broadcast one hour later) than by the use of disinfectants or resistant varieties. It is

suggested that the influence of depth of sowing may be studied with advantage in the case of other seed and soil borne seedling-infecting diseases also. T. S. R.

Antdhelmintic activity of crystalline papain. J. Berger and C. F. Aserjo, *Science* 91 : (1940) 387—388.

The use of certain plant juices as worm killers is known from ancient times but has been neglected in recent years. Reports are available of successful use of the crude milk from papaya fruits against intestinal worms during the last century. Experiments have shown that round worms are completely digested in 16 hours by 0·11 percent concentration of crystalline papain. This is 14 times as active as commercial preparations. Bromelin obtained from fresh pineapple juice and crystalline ficin obtained from the latex of Ficus species also can digest round worms. This capacity is attributed to protein-dissolving enzymes present in these juices. But there is evidence to show that other plant juices containing these enzymes do not possess this capacity of digesting live worms T. S. R.

EXTRACT

Cleanliness In Dairy Routine

Much has been written on " cleanliness " in the various phases of the production of topgrade dairy products, i. e., washing utensils, cleaning separators, milking machines and so on, and it will be readily admitted that this subject is of paramount importance to the dairy farmer who is paid according to grade for his produce. This article has been written in an endeavour to include the most important sections of all these operations under the heading of " cleanliness in the dairy routine". Taking the various operations in order of their occurrence, the first point which warrants close attention is :—

Cleanliness of the Cow :— The hair of the coat and on the udder is a fruitful source of bacterial contamination when the cows come in from the paddocks. In the summer bacteria-laden dust invariably exists on the hair, and in the winter when the cows are wet with rain or dew the drops of water contain many thousands of bacteria allowed to drop into the milking bucket. It is recommended that a cloth which has been dampened with a dilute solution of potassium permanganate (Condy's crystals) should be used to wipe over the flanks and udder of the cow immediately prior to milking. The first squirt of milk from each teat should be discarded for the reason that bacteria find their way into the teat from the exterior and multiply there between milkings.

Methods of Milking :— It is a well-known fact that so-called " wet milking " is definitely a contributing source of the bacteria in milk. A smear of petroleum jelly on the teats should obviate the necessity for wetting the milker's hands with milk and has the effect of keeping the teats in healthy condition. Cleanliness and health of persons tending the cows, of course, is essential in the production of bacteriologically clean milk.

Cleansing of Separator and Utensils :— In cleansing the separator and dairy utensils three processes are necessary, any one of which is useless unless combined with the other two :—

(a) Washing with lukewarm water to remove the curdy sediment which, if left, will form upon subjection to heat an insoluble substance (milk-stone) which is particularly difficult to remove.

(b) Washing and scrubbing with scalding hot water containing washing soda or other recognized dairy cleanser.

(c) Sterilization with steam. A simple steaming device for placing over copper vessel of boiling water is described in Leaflet No. 424 which may be obtained on request.

It may be said here that the growth of organisms from the time of washing and sterilizing to the time of the next milking can be very great and therefore considerable benefit can be derived by a second sterilising of all utensils immediately prior to milking with either stream or chemical sterilizers containing chlorine compounds. Chlorine distinfectants are marketed at present in powder form which is preferable to liquid chlorine disinfectants, as the powder is less likely to deteriorate in storage. All utensils, after sterilising, should be placed on racks so that the metal surfaces dry out rapidly. Bacteria will multiply in the presence of moisture. It is also necessary to have yards, bails and surroundings in clean condition, in order to minimize contamination with dust, dung etc. With this in view, compliance with the following conditions taken from the Health Act, 1911–1919, regulations has become necessary;

(a) The floor of a properly constructed milking shed must be concrete or other impervious material and correctly drained into an open impervious drain at least 20 feet away from the shed.

(b) A milk and cream storage room must be built on approved lines with a concrete floor and properly ceiled and ventilated, also fly-proof and be at least 10 feet from the milking shed.

(c) Provision must be made for boiling water to be available at the bails immediately adjacent to the washing up facilities in use.

(d) Cow bails and sheds must be lime-washed or painted with other suitable preparation. A 4-foot dado of tar or bituminous paint is recommended at being simple to wash down.

It may be said in conclusion that only a few cases of unsatisfactory milk or cream quality are traceable to any single source of origin, but most cases are due to a culmination of many small and seemingly unimportant foci of bacterial contamination which can only be eliminated by careful attention to detail as outlined above in every operation of the dairy routine. *Tropical Agriculturist* 94: (1940) 303—304.

Vitamin-hormone stimulant—in powder form.

From the Horticultural Department of the American Chemical Pains Company comes news of the commercial production of a vitamin-hormone stimulant, Transplatone, for plants, that not only invigorates old roots but also multiplies the production of new ones, reduces the loss which frequently occurs with transplanting operations, and reduces wilting. It is applied to rooted plants to add to existing root growth and to force their general growth. Transplantone is a water-soluble powder impregnated with Vitamin B_1 and other parts of the Vitamin B fraction, plus root-promoting hormones. The hormone initiates root growth and plant physiologists assert that the Vitamin B chemicals are necessary for the maintenance of their growth. That it is quite concentrated is obvious for it requires only one level teaspoonful to a gallon of water to make a stock solution which is then further diluted. Seedlings may be lightly sprinkled weekly, or it may be applied to plants set out in the soil, whether they be trees, shrubs, vines, annuals, or perennials. In the case of plants which are set out without a ball of earth, the manufacturer recommends that the roots be soaked in the stock solution for an hour. Treatment usually results in vigorous and extensive root growth and this, in turn, requires more frequent watering than is ordinarily necessary. The manufacturer further claims that, owing to frequent clipping, grass is unable to produce enough vitamin and hormone naturally for the roots and that watering with an ounce of stock solution to three quarts of water will improve turf quality. Sods similarly treated before being set in place will also readily form new roots.— C. F. Greeves—Carpenter. *(Scient. Amer.* 163, (1940) 85—86).

Gleanings.

Cotton Writing Paper. Details are as yet unavailable as to the new process for making a high quality writing paper directly from cotton—low-grade cotton at that—but the development work was done by the U. S. Department of Agriculture in co-operation with the Writing Paper Manufacturers' Association. Provided that the process is a commercial success and paper can be made cheaply enough to create a big demand for it, then this should solve a sizeable part of the problem of what to do with America's surplus cotton. (*Scient. Amer.* 163, (1940) 90).

Wholesome Milk. Normal milk can only be produced by a normally healthy herd, fed on wholesome and non-taint producing fodders. If only one cow in the herd is not in normal health her milk production will be sub-normal, and, if mixed with the milk from the remainder of the herd, the quality of the whole may be seriously affected. Cleanliness should be exercised during the whole process of milking and all utensils and surroundings kept clean.

If the milk is intended for human consumption, cooling and aerating will allow the flavours to be given off, and the reduction in temperature will check bacterial development. *Queensland, Agr. Jou.* 53: (1940).

Acreage under bananas in New South Wales. On 31st March 1940, there were 17,211 acres under bananas in New South Wales which is an increase of 1,367 acres over the acreage of the previous year. *Agr. Gaz. N. S. Wales.* 51: 382.

Reviews.

Indian Indigenous Milk Products by W. L. Davies, Director of Dairy Research in India (Thacker Spink & Co. Ltd., Calcutta).

In this book of about 100 pages Mr. W. L. Davies describes the utilization of milk in India for the manufacture of indigenous milk products. The methods of their manufacture, the scientific principles involved in their preparation, their composition (physical, chemical and biological), their properties (including nutritional), and uses to which they are put, are briefly and clearly explained.

The first chapter deals with the composition of milk; the second treats of *khoa*, *kheer*, and *rabbri*; the third deals with the fermented milks, *dahi* (curd) and *lassi* (butter milk); the fourth and fifth deal with local butter and *ghee* (clarified butter); the sixth deals with miscellaneous products as creams (*malai* and *sar*), cheese and *channa* and the last chapter indicates the possibilities of the utilisation of milk for the manufacture of western products as creamery butter, cheese, condensed milk, dried milk, and tinned cream, which we are importing in increasing quantities every year.

The book contains suggestions on almost every page for improvement and research and as the author says, it will be useful for all those interested in the development of the Indian dairy industry, especially, students of dairying, agriculture, and animal husbandry; biochemists, analysts, and technologists. The book is an important addition to the very meagre list of books on Indian dairy industry.

T. N.

Insect Pests of The Punjab. By Khan A. Rahman, B. Sc., Ph. D., F. R. E. S. *The Punjab Agricultural College Magazine* May to July '40.

This article contains useful information on some of the major pests of important crops and stored produce in the province. Short notes on the pests

are given under the following heads:—identification, distribution and food plants, damage and control. The scientific names of the pests and references for those who require more detailed information are also given in small type. Besides these, the preparation and use of the different insecticides and descriptions and prices of the spraying and dusting machines recommended by the Department also find a place in the publication. The illustrations given in the article add to the value of the publication as they will be found useful in the identification of the pests. The author states that he has compiled the information on the different pests and their control from the various publications of his predecessor Khan Bahadur M. Afzal Husain, M. Sc., I. A. S., Entomologist for 18 years and now Vice Chancellor of the Punjab Universisty—whom he considers as the father of Entomology in the Punjab. A word of praise is due to Mr Rahman who has, for the first time, brought together in one publication information on the insect pests of the Punjab scattered over in the numerous publications. He has succeeded in his attempt to give in a concise form sufficient information to meet the needs of the student and agriculturist and, to some extent, of the research worker. With better care and attention, the errors for which an errata slip has already been issued could have been avoided. These, however, need to be corrected at the time of the second edition of the publication.

M. C. C.

Annual Review of Bio-Chemical and Allied Research in India—Vol. X, 1939.

This book has been published by the Society of Biological Chemists, India. It is priced Rs. 3 and is available with the Honorary Secretary of the Society, Hebbal P. O., Bangalore. It contains in a clear and concise manner, the latest results of research work done in India, in Pharmacology, human physiology and pathology, industrial chemistry, foods and nutrition, soils, fertilisers, manures, plant physiology and phytopathology. Bengalgram is said to be the best from nutritive value, with greengram coming a close second. In view of this decision, which has also been corroborated by Akroyd, it is for consideration, whether the cultivation of soya beans should be encouraged in this country. Tapioca as a staple article of diet is said to be unsatisfactory because of a deficiency in the quantity and possibly the quality of its protein. A technique has been developed in which insects are made use of, as test animals, for nutritional and vitaminic studies. Black gram husk and *agathi* leaves, have been reported to be found adulterated in tea. A preliminary soil map of India, which will satisfy a long felt need, is reported to be under preparation.

The results of the competition sponsored by Marsland Price & Co., Ltd., at the instance of Mr. Walchand Hirachand, offering a prize of Rs. 1,000, for growing 100 tons or more of sugarcane per acre, has revealed some interesting facts. Out of twenty-one, 3 competitors, showed a tonnage of over 100 tons, of stripped cane. In addition to thorough and deep preliminary cultivation of the land, heavy manuring was resorted to in these cases, consisting of 30 cartloads of farm yard manure, 4 tons of oil cake and 4 bags of ammonium sulphate per acre in addition to green manuring and sheep folding. The expenses of manuring alone came to Rs. 350 to Rs. 400 per acre and including other items of cultivation, the total expenses came to about Rs. 750 per acre or Rs. 7 per ton of cane.

The review is well edited and is worth reading. M. K. R.

Crop & Trade Reports.

Cotton—First Forecast Report 1940-41. The average of the areas under cotton in the Madras Province during the five years ending 1938-39 has represented 9·7 per cent. of the total area under cotton in India. The area under cotton up to

the 25th July 1940 is estimated at 235.100 acres. When compared with the area of 149,000 acres estimated for the corresponding period of last year, it reveals an increase of 57·8 per cent.

Central districts and South—Mainly Cambodia tract. The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts rose from 86,500 acres to 146,100 acres due mainly to favourable rains in April and May 1940. The yield is expected to be generally normal.

Western tract. The area under Westerns rose from 28,400 acres to 61,300 acres. The increase in area in the current year is due mainly to the good rains received in the Bellary district in the early part of the *mungari* season.

White and Red Northern tract. The area under white and red northerns rose from 12,000 acres to 13,500 acres, i. e., by 12·5 per cent.

Warrangal and Cocanadas tract. The area under Warrangal and Cocanadas cotton fell from 15,600 acres to 8,200 acres, i. e., by 47·4 per cent.

The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 5th August 1940 was Rs. 16—7—0 for Cocanadas, Rs. 16—10—0 for white northerns, Rs. 17-4-0 for red northerns, Rs. 14-9-0 for westerns (mungari crop), Rs. 17—7—0 for Westerns (jowari crop), Rs. 28-14-0 for Coimbatore Cambodia, Rs. 20—15—0 for Southern Cambodia, Rs. 26—10—0 for Coimbatore Karunganni, Rs. 20—8—0 for Tinnevelli Karunganni, Rs. 19—0—0 for Tinnevellies and Rs. 22—5—0 for Nadam cotton. (*From the Director of Industries and Commerce*).

Cotton—Intermediate Forecast Report 1940-41. *Last year's crop.* The yield of the second or summer pickings of the 1939-40 crop is estimated to be generally normal.

Current year's crop. The main season for sowing is not yet over in most parts of the Province. Sowings of the crop are in progress in the Circars and the Deccan. The condition of the early sown crop is generally satisfactory.

The average wholesale price of cotton lint per Imperial maund of 82,2/7 lbs. equivalent to 3,200 tolas as reported from important markets on 2nd September 1940 was Rs. 14—13—0 for Cocandas, Rs. 17—4—0 for Red Northerns Rs. 16—10—0 for White Northerns, Rs. 13—10—0 for Westerns (*mungari* crop), Rs. 17—5—0 for Westerns (*jowari* crop), Rs. 27—15—0 for Coimbatore Combodia, Rs. 20—4—0 for Southern Cambodia, Rs. 26—2—0 for Coimbatore Karunganni, Rs. 19—0—0 for Tinnevellies and Rs. 21—4—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 5th August 1940, these prices reveal a fall of ten per cent in the case of Cocanadas, six per cent in the case of Western (*mungari*), five per cent in the case of Nadam, three per cent in the case of Coimbatore Cambodia and Southern Cambodia, two per cent in the case of Coimbatore Karunganni and one per cent in the case of Western (*hingari*), the prices of Northerns (Red and white) and Tinnevellies remaining stationary. (*From the Director of Industries and Commerce*).

Sugarcane—Intermediate condition report 1940. The condition of the sugarcane crop is satisfactory in all the districts outside Vizagapatam where it was adversely affected by the very heavy rains of May. A normal yield can be expected in the other districts if the season continues to be favourable.

2. The wholesale price of jaggery per imperial maund of 82,2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 9th September 1940

was Rs. 5—11—0 in Mangalore, Rs. 5—0—0 in Erode, Rs. 4—15—0 in Salem, Rs. 4—14—0 in Cuddalore, Rs. 4—10—0 in Cocanda and Rajahmundry, Rs. 4—5—0 in Vizianagarm, Rs. 4—2—0 in Adoni and Chittoor, Rs. 3—14—0 in Vellore and Coimbatore, Rs. 3—7—0 in Vizagapatam, Rs. 3—1—0 in Trichinopoly and Rs. 2—14—0 in Bellary. When compared with the prices published in the last report, i. e., those which prevailed on 5th August 1940, these prices reveal a fall of approximately 16 per cent in Bellary, ten per cent in Vizianagaram, six per cent in Rajahmundry, Vellore, Salem and Trinchinopoly five per cent in Vizagapatam, four per cent in Chittoor and one per cent in Cuddalore, the prices remaining stationary in Cocoanda, Adoni, Erode, Coimbatore and Mangalore. (*From the Director of Industries and Commerce*).

Ginger—First forecast report 1940. The area under ginger up to 25th August 1940 is estimated at 12,000 acres in Malabar and 800 acres in South Kanara. The condition of the crop is generally satisfactory except in parts of the Malabar district where the crop is affected by "soft-rot" to some extent. (*From the Director of Industries and Commerce*).

Pepper—First Forecast Report 1940. The area under pepper up to 25th August 1940 in the districts of Malabar and south Kanara is estimated at 102,500 acres 94,000 acres in Malabar and 8,500 acres in South Kanara, as against 102,300 estimated for the corresponding period of the previous year. The yield is expected to be normal.

The wholesale price of pepper per Imperial Maund of 82,2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 9th September 1940 was Rs. 10—1—0 at Calicut, Rs. 9—13—0 at Tellicherry, and Rs. 10—2—0 at Mangalore. When compared with the prices which prevailed on the 8th January 1940, these prices reveal a fall of about 22 per cent in Mangalore, 16 per cent in Tellicherry and 13 per cent in Calicut. (*From the Director of Industries and Commerce*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 13th September 1940 amounted to 425,020 bales of 400 lb. lint as against an estimate of 3,66,800 bales of the total crop of 1939-40. The receipt in the corresponding period of the previous year were 411,134 bales. 415,550 bales mainly of pressed cotton were received at spinning mills and 113,286 bales were exported by sea while 109,386 bales were imported by sea mainly from Karachi, (*From the Director of Agriculture*).

College and Estate News.

College. The Students of the third year B. Sc. (Ag.) class were given a course of special lectures on Poultry-farming by Sri H. Narahari Rao, Assistant in charge of Poultry, Panagal Demonstration Farm, Kalahasti.

Examinations. The first terminal examinations for the 1st, 2nd and 3rd year classes commenced with practicals in the first week of September and were finished by 13th. The College closed for the Michaelmas vacation on the 15th and will reopen on the 4th October. The final year students were, however, permitted to leave the College on the 13th as they have to assemble on the 1st October for their tour.

Students. The Educational tour of the final year B. Sc. (Ag.) begins from 1st of October.

Agricultural Research Station, Gudiyattam	October	2nd & 3rd
Fruit Research Station, Kodur	,,	4th & 5th
Agricultural Research Station, Hagari	,,	7th & 8th
Irrigation Research Station, Siruguppa	,,	9th & 10th
Hebbal Agricultural School, Bangalore Imperial Dairy Institute, Bangalore Lal Bagh Gardens, Bangalore	,,	11th, 12th & t3th
Live-stock Research Station, Hosur	,,	14th & 15th
Return to Agricultural College, Coimbatore	,,	16th

Hostel. Consequent on the great reduction in the number of students remaining in the hostel during the Michaelmas holidays the regular four messes of the Hostel are temporarily suspended and instead a special mess is run for the duration of the holidays.

Club activities. A highly educative and instructive lecture was delivered by Sree N. Subrahmaniam, B. A., B. L., under the auspices of the Students' Club on 30—8—40. Sri. Sheshavataram occupied the chair. The speaker dwelt upon the Development of Co-operation in Agriculture laying emphasis on its evolution and how the intrinsic desirability of adopting such co-operation came to be realised in foreign countries and exhorted the students that special responsibilities lay on their shoulders to educate the opinion of the Indian farmers as to the vast utility and immense significance of co-operation among agriculturists.

Games: Cricket. The students of the Agricultural College had a fixture with the Palghat Victoria College, on 24th August '40 and snatched an easy victory. Palghat 108 for 6 wickets (Venu 25, Srinivasan 21, Somanna 2 for 28, S. V. Srinivasan 2 for 26). Agricultural College 168, (B. S. Krishnan 28. S. V. Srinivasan 23, C. Sankara Rao 37, Devadas Kamath 54 (not out).

The first match of the Rhondy Shield Cricket tournament was played against Government Arts College Coimbatore, and resulted in an easy victory for the Agricultural College. Government College, 53; (Somanna 3 for 14. S. V. Srinivasan 3 for 18 and Hegde 3 for 3.) Agricultural College 109 for 5 (B. S. Krishnan 18, Nageswara Rao 19. K. M. Somanna 35, not out.)

We were taught a bitter lesson to restrain unruly confidence when we sustained rather an awkward defeat at the hands of the Salem Gymkhana Club on 1—9-40. Agricultural College 44; C. N. Babu 14. (J. V. Brown 4 for 17 and McHatton 3 for 4) Salem Gymkhana 193 for 7. K. B. Nagesh 71, Venkatachari 49, Spittler 54, (S. V. Srinivasan 3 for 14).

On 5—9—40 the second match of the Rhondy Shield tournament was played against the Scout Recreation Club, Coimbatore on Government College grounds. Our College kept up the tradition by winning the match easily. S. R. C. XI—53; A. Suri 21, S. V. Srinivasan 3 for 17, Hegde 3 for 15, Somanna 3 for 5.) Agricultural College 208; H. Shiva Rao, 49, Krishnan 22, C. N. Babu 41. Shanker Rao 31, Kodandaraman 34.)

There was a proposal to have a games tour during the Michaelmas holidays but the matter was dropped owing to financial exigencies.

Personal. Mr. R. C. Broadfoot, who had been to Madras, for medical treatment has returned to Coimbatore after undergoing a successful abdominal operation. He is now convalescing at Coimbatore and it is hoped that he will rejoin duty next month.

Moffussil News and Notes.

Salem Agricultural Exhibition. An Agricultural Exhibition was put up during the All India Swadeshi and Industrial exhibition organised by the Salem Municipality between the 5th and 21st of the month. Improved Iron implements,

strains of heavy yielding varieties of cereals, millets, groundnut, cotton and sugarcane evolved from Government farms, fruits, and industrial products prepared from these, insect pests and plant diseases with remedial and control measures and Bee-keeping formed the main items of the display. The exhibits commanded considerable attention of the ryot classes and elicited interested inquiries. An average attendance of between 800 to 1300 was recorded from the commencement to the termination of the exhibition during a period of 16 days. A practical demonstration of the use of iron ploughs was also given on one of these days.

A. R.

Weather Review—AUGUST 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	20·9	+13·1	63·9
	Calingapatam	10·6	+2·7	36·9
	Vizagapatam	4·5	−0·9	21·0
	Anakapalli*	0·0	0·0	0·0
	Samalkota*			
	Maruteru*	8·2	+1·2	26·0
	Cocanada	5·9	+0·4	28·3
	Masulipatam	7·6	+0·7	19·1
	Guntur*	0·0	0·0	0·0
Ceded Dists.	Kurnool	6·5	+1·5	18·2
	Nandyal*	7·1	+1·6	13·4
	Hagari*	1·8	−2·0	13·5
	Siruguppa*	4·5	+1·0	14·0
	Bellary	1·7	−0·6	13·7
	Anantapur	1·3	−0·9	7·0
	Rentachintala	3·3		15·8
	Cuddapah	2·7	−3·1	20·8
	Anantharajupet*	4·0	+1·3	17·3
Carnatic	Nellore	1·0	−2·3	13·8
	Madras	4·0	−0·6	15·2
	Palur*	3·8	−1·3	11·0
	Tindivanam*	4·6	−0·3	13·8
	Cuddalore	4·1	−0·9	11·3
Central	Vellore	3·2	−3·1	13·6
	Salem	2·2	−4·6	22·1
	Coimbatore	0·7	−0·4	15·5
	Coimbatore A. C. & R. I.*	1·0	−0·2	12·9
	Trichinopoly	0·6	−3·2	9·9

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·4	−3·2	6·2
	Aduthurai*	2·0	−1·1	12·3
	Madura	6·4	+2·1	19·9
	Pamban	0·0	−0·7	11·5
	Koilpatti*			
	Palamkottah	0·1	−0·5	7·1
West Coast	Trivandrum	6·8	+2·7	45·8
	Cochin	23·9	+11·0	100·1
	Calicut	26·0	+10·4	106·1
	Pattambi*	20·9	+6·1	81·8
	Taliparamba*	38·9	+14·0	130·9
	Kasargode*	41·9	+18·3	130·5
	Nileshwar*	39·8	+14·3	139·7
	Mangalore	47·6	+25·1	127·4
Mysore and Coorg	Chitaldrug	2·9	−0·1	16·5
	Bangalore	3·1	−2·3	18·8
	Mysore	1·7	−1·6	18·7
	Mercara	34·0	+8·5	126·5
Hills	Kodaikanal	4·1	−2·9	31·9
	Coonoor			
	Ootacamund*	5·4	−1·8	30·9
	Nanjanad*	5·2	−1·7	31·9

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The monsoon was generally active over the peninsula, under the influence of four depressions in the Bay of Bengal. The first depression originated as an area of unsettled weather at the head of the Bay on the 1st and developing into a storm crossed the South Bengal coast on the 2nd and 3rd and finally disappeared over the United Provinces on the 11th. The second depression appeared off the Circars Orissa coast on the 12th and moving inland merged into the seasonal low

by the 15th. The third depression appeared as a low off the Orissa coast on the 7th and developing into a depression by the 21st off Puri, passed inland on the next day and disappeared over Central India by the 25th. The fourth depression appeared about 100 miles south east of Calcutta on the 26th and moving inland, disappeared by the 31st of the month.

Rainfall was particularly heavy on the West Coast of the peninsula between the 10th and the 14th and on the Circars-Orissa coast between the 17th and 22nd during the passage inland of the third depression.

Rainfall was in large excess in parts of the Circars, and West Coast, and in slight excess in the Ceded Districts, nearly normal in the Carnatic and below normal elsewhere.

The chief reports of heavy rainfall in 24 hours were :
Mangalore 4·1″ (10th) ; 6·5″ (12th) and 4·5″ (13th) ;
Cochin 4·1″, Irinjalakuda (Cochin) 8·9″;
Peermade (Travancore) 6·4″; Cranganore (Cochin) 6·3″;
Kasargode 6·4″ and Ankamalli (Travancore) 7·0″ (all on the 14th).
Narasapur (W. Godavary) 6·5″ and Jeypore (Ganjam) 5″ (on the 17th).
Gopalpore 9·0″ (21st) and 4·2″ (22nd).

Weather Report for the Agricultural College and Research Institute Observatory.

Report 8/40.

Absolute maximum in shade.	...	91·5°F
Absolute minimum in shade.	...	68·0°F
Mean maximum in shade.	...	86·9°F
Departure from normal.	...	nil.
Mean minimum in shade.	...	71·9°F
Departure from normal.	...	+0·8°F
Total rainfall for the month.	...	0·99″
Departure from normal.	...	−0·20″
Heaviest fall in 24 hours.	...	0·34″ on the 13th.
Total number of rainy days.	...	3
Mean daily wind velocity.	...	5·4 m. p. h.
Departure from normal.	...	−1·6 m. p. h.
Mean humidity at 8 hours.	...	72·3%
Departure from normal.	...	−1·7%

Summary. The weather conditions were slightly unsettled during the 1st half of the month when a total rainfall of 0·99″ was recorded. The rainfall was in defect by 0·2″. Skies were moderately to heavily clouded and the humidity was in slight defect. The mean maximum temperature was normal while the mean minimum was slightly above normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Appointment.

Sri. L. Narasimha Acharya, Agricultural Demonstrator, Chittoor is appointed to officiate as Assistant Director of Agriculture in Category 6, class 1 Madras Agricultural Service and is posted to Bellary vice Sri. R. N. K. Sundaram appointed as Deputy Director of Agriculture, II Circle, Cuddapah.

Transfers.

Name of officers.	From	To
Sri. R. Chokkalingam Pillai,	Asst. D. A., (on leave)	Asst., D. A., Tinnevelly
„ V. T. Subbayya Mudaliar	Offg. Asst. D. A., Tinnevelly.	Offg. Asst. D. A., Bellary.

Subordinate Services.

Transfers.

Name of officers.	From	To
Mr. Syed Ibrahim Sahib	F. M., A. R. S., Kodur	A. R. S., Hagari.
„ S. Suryanarayana,	A. D., Kirlampudi,	Special duty at Sugar Factory, Vuyyuru.
„ G. L. Narasimha Rao,	Asst. A. D., Vuyyuru Sugar Factory,	Special duty under the Sugar-cane Growers' Union, Kirlampudi.
„ V. N. Subbannacharya	A. D., (on leave)	A. D., Rayadrug.
„ D. Satyanarayan,	F. M., A. R. S., Anakapalle	A. D., Challapalle.
„ N. Krishna Menon,	Sub-Asst. in Entomology, Coimbatore,	Special duty, Vadavanur.
„ R. Krishnamurthi,	A. D., Saidapet,	F. M. Nandyal.
„ M. P. Narasimha Rao,	A. D., (on leave),	Asst. in Cotton. Guntur.

Leave.

Name of officers.	Period of leave.
Sri T. K. Balaji Rao, A. R. S., Aduthurai	L. a. p. for 3 months from 5—8—40.
„ R. Krishnamurthi, A. D., Saidapet	Extension of l. a. p. on m. c. for 1 month from 24—8—40.
„ R. Guruswami Naidu, A. D., Kaikalur	Extension of l. a. p. for 45 days from 31st August 1940.
„ J. Suryanarayana, A. D., Gurzala	L. a. p. on m. c. for 3 months from 19—8—40.
„ S. Kuppuswami Ayyangar, A. D., St. Thomas Mount	Extension of l. a. p. for 2 months from 26—8—40.
„ M. P. Sankaran Nambiar, A. D., Dharapuram	L. a. p. for 3 months and 15 days from 9—9—40.
„ A. G. Ramaswamiah, Sub-Asst. in Entomology, Coimbatore	Extension of l. a. p. on m. c. for 2 months from 6—9—40.
„ P. Vishnusomayajulu, Asst. in Mycology, Coimbatore	L. a. p. for 1 month from 9—9—40.
„ K. M. Jacob, A. D., (on leave)	Extension of leave on half average pay on m. c. for 2 months from 11—9—40.
„ C. S. Namasivayam Pillai, A. D., Nanguneri	L. a. p. on m. c. for 2 months from the date of relief.
„ E. Kunhappa Nambiar, Permanent Upper Subordinate and Assistant Director of Agriculture, St. Thomas Mount.	L. a. p. for 2 months with effect from the 5th September or the date of relief.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

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EDITORIAL

Export of Sugar. A press communique recently issued by the Government of India stated that the application made for the partial release from their obligations, under the International Sugar Agreement so as to enable India to export to the United Kingdom up to 200,000 tons of sugar during the year ending 31st December, 1940, has been granted. Early in the year, the Indian Sugar Syndicate carried out negotiations with the British Ministry of Food for exports of Indian Sugar to Britain but these negotiations failed owing to disagreement over the price. It was then stated that the industry was prepared to sell a portion of the surplus stock estimated at over two lakh tons at reduced prices, if the Government of India offered certain concessions in regard to railway freights and excise duty. As these concessions were not forthcoming the whole transaction fell through. We are, however, glad to learn that the Syndicate at an extraordinary meeting held on 22nd October, 1940 in view of the export facilities accorded, appointed a committee to meet the Government representatives and negotiate the terms of an agreement. We wish the forthcoming meeting the success it deserves. The United Kingdom, imports over two million tons of sugar annually from outside. It should be possible for her to buy at least a portion of her requirements from India, a member of the British Empire. This will certainly give an outlet for the surplus stock now available in India and place her sugar industry on a firm basis. It is our sincere hope that the special facility now extended to India will, in course of time, lead to a permanent agreement of mutual benefit to the countries.

Tobacco Marketing. The report issued by the Agricultural Marketing Adviser to the Government of India on the marketing of tobacco in India reveals several points of interest to the Indian grower. India produces about one fourth of the world's tobacco and further many well known brands of cigarettes are manufactured in India for which large quantities of locally grown tobacco are used. More than half the Indian production is concentrated in five clearly defined zones viz., the North Bengal and North Bihar for production of *hookah* and other types of tobacco, the *charotar* area in Gujaret along with that of Nipani in the South of the Bombay Presidency have a special reputation for their *bidi* tobaccos, while Guntur is outstanding for the production of high class cigarette leaf. The wholesale value of all tobacco products in India is estimated to be about 37 crores of rupees. It

constitutes, therefore, an important source of ready cash to the cultivators. In the Guntur district about two-thirds of the area is now under Virginia types of tobacco which yield on an average about 750 lbs. of raw leaf or about 400 – 500 lbs. of processed leaf per acre.

The largest volume of the international trade consists of flue-cured tobacco for which the demand is steadily increasing. The total production of this type in India, is reported to be only about 2 per cent of the total.

There is a certain amount of satisfaction to be found in the fact that imports of cigarettes into India have shown a more than corresponding decrease. The *per capita* consumption in Madras is reckoned to be only 10 cigarettes per annum. The general trend of tobacco consumption in India is upward particularly in the case of cigarettes. It is essential that in those areas considered suitable for the production of Virginia cigarette tobacco, the growers should realise the great importance of quality and continue their efforts to improve it. That there is ample scope for expanding the market for high quality Indian tobacco is clear from the progress made in recent years in the Guntur district. The high quality of the cured Virginia produced there, is continuing to displace American leaf imported for cigarette making. Statutory grades for cigarette leaf have already been prescribed under the Agricultural produce (grading and Marking) Act, 1937, which define the grades on the basis of colour, texture and freedom from blemish. It is interesting to note that although standard grades have only been in operation for cigarette tobacco in the Guntur area for less than two years, there is already a large body of opinion amongst growers, merchants, exporters and manufacturers that it would be to the advantage of all if steps could be taken to ensure that all cigarette tobacco grown and exported from that area could be graded and marked in accordance with the provisions of the Agricultural Produce (Grading and marking) Act. On an average, of the prices realised for Virginia flue-cured tobacco (stripped) in the United Kingdom markets, the grower from Guntur is estimated to get about 42·3 per cent for his leaf, while the exporter's margin amounts to 16 per cent. The balance viz. 41·7 per cent represents loss in moisture, stripping charges on grading, packing, transport, insurance, landing charges, rent, brokerage, marketting etc. In 1923, there were only 11 cigarette factories in India while in 1935 the number increased to 22. The annual production of cigarettes in India, is estimated at about 7,500 million cigarettes valued at nearly six crores of rupees. It is clear from the report that there is still considerable scope for increasing the cultivation of the Virginian type of tobacco. We hope the cultivators will take advantage of the situation and extend the area. Like sugar, cotton and cement industry, considerable progress can be expected from tobacco industry in the course of a few years, provided the crop is tackled in the right direction in all stages, cultivation, marketing and manufacture.

Rock Bee Honey, its Extraction and Preservation.

By M. C. CHERIAN, B. A., B. Sc., D. I. C.
and
S. RAMACHANDRAN, L. Ag.
Agricultural Research Institute, Coimbatore.

Introduction. The Rock bee *(Apis dorsata,)* has been the main source of honey in India from time immemorial, though the quality of the material available to the public was poor. The recent introduction of modern methods of beekeeping and their rapid spread in this presidency have revolutionised the popular notion about pure honey. Machine-extracted honey from the domesticated Indian bee *(Apis indica,)* always fetches a good price, while Rock bee honey is not so popular on account of its impure and sometimes fermented condition when it reaches the consumer. A study of the existing methods of honey extraction and preservation was therefore taken up and the possibilities of improvement explored. The present paper contains a short account of the trials conducted and the results obtained, therefrom.

The Rock bee. Before giving the details of these trials, a short description of the Rock bee and its peculiar habits will not be out of place here. Of the four indigenous honey bees, viz., the Rock bee, the Indian bee, the Little bee and the Dammar bee, the first one is the biggest in size. Its favourite haunts are hilly and forest areas, mostly above 2000 feet elevation, but stray colonies are often found on the plains also. Swarms of this bee establish themselves in the open in inaccessible places such as precipitous cliffs and over-hanging rocks, branches of tall trees, etc. Occasionally 50 to 60 colonies are found on a single tree. The combs are built singly and very often reach three feet in length and about two feet in breadth. The top portion of the comb is about nine inches where honey and pollen are stored bulges out to a width of about six inches. The brood is reared in the lower portion. This bee is a very good honey-gatherer and a strong colony may yield up to 40 lbs. In spite of its good honey-gathering qualities, this bee has, unfortunately, a few undesirable traits which render it unfit for domestication. The single comb building habit, necessitates the destruction of the brood while extracting honey. This unnecessary destruction of life and crushing of the comb is against the very fundamentals of scientific beekeeping. On the other hand the Indian bee constructs a series of parellel combs and invariably stores honey separately from the brood. Under domesticated conditions the honey combs can be easily taken out for extraction of honey and the empty combs given back without disturbing the normal working of the colony. Secondly the Rock bee is easily irritable and vindictive when provoked. It has been reported that men and domestic animals are sometimes stung to death. Lastly this bee is migratory in habits; visiting the hills during the summer months and moving down to the lower elevations after the outbreak of the

monsoon. The domestication of this bee, therefore, seems to be out of question and only better methods of extraction and preservation of honey can be suggested.

Existing methods of honey extraction and preservation. The handling of these bees and the collection of honey and wax are exclusively done by the jungle tribes. They know by experience the seasons of honey flow and the combs are taken only when they are sure that a good quantity of honey has been stocked in them. As a general rule the colonies are handled only after night fall. The ingenuity, coolness and daring exhibited by these "children of the forest" while approaching colonies of these dangerous insects are simply amazing. Before beginning the work, they fortify themselves against any accident or attack by the bees by a preliminary "puja" to propitiate the jungle dieties. In cases where colonies of the bees have established themselves under overhanging rocks, the approach often extends to a few hundred feet over the steep precipices, a slip from which would mean loss of life. The equipments required for approaching the colonies and collecting the honey are a few lengths of forest canes tied together with jungle fibre or a sufficient length or strong fibre rope, a kerosine tin open at the side and slung to a long rope and the inevitable smoking torch. One end of the cane or rope is well secured to a tree at the top and the man gets down to the work spot with the help of this improvised ladder. The task appears to be comparatively easier, in cases where the colonies are found on trees; as the men easily climb up even to the dizzy heights at which the colonies are found. When there are a number of colonies on different branches of the same tree, they move from branch to branch with the help of bamboos tied across them. The crowning feat of their admirable skill and daring lies in the fact that all this work is done in pitch darkness. When they have to tackle a larger number of colonies they are able to camp the whole night either under the rocks or on the top of the trees.

Regarding the collection of the honey, the bees are first brushed aside with the smoking torch. The brood portion is then broken off and sent down in the kerosine tin. The empty tin is sent up again to get the honey comb. It takes only about 5 to 10 minutes to tackle each colony.

The brood combs are sometimes boiled and eaten by the jungle tribes but the bulk of them is kept for wax extraction. The honey combs are then taken and the small bits of brood that may be still adhering to them are removed. The honey is then squeezed out with the hand and is either handed over to the contractors immediately or sold locally. No attempts are made to store the honey. It is needless to add here that the methods are thoroughly unclean and the quality of honey very poor on account of the admixture of considerable quantities of pollen and possibly some brood-juice as well. Till recently the Forest Department were leasing out the right of collecting honey and wax. Realising the possibilities of improving

the methods of collecting this very useful forest produce, the Department has now taken up the work under its own supervision in certain centres. According to the figures kindly furnished by the Forest Utilisation Officer, about 45,000 lbs. of honey are said to be available from the few centres where they carry on the honey collection departmentally. Cleaner methods are adopted in getting the combs and squeezing out the honey. The squeezed honey is filtered, then boiled directly over fire and filtered again before storing in kerosine tins. These methods, though they are an improvement over the existing crude ones, are still far from being perfect. There is always a possibility of large quantities of pollen getting forced out along with the honey when it is squeezed out by the hand. The presence of the extraneous matter as well as the contamination by hand cause rapid fermentation of the honey. The direct boiling over fire will ruin the essential qualities of honey, as the enzymes contained therein are destroyed at this high temperature. But recently the Department appears to have taken up the scientific ripening of honey.

Trials of honey extraction and preservation. Trials were, therefore, started to improve the existinq method of extraction and preservation of honey. The main principles underlying the trials were (a) clean and hygienic extraction of honey and (b) its proper preservation. Three appliances viz., the honey press, the honey strainer and the centrifugal honey extractor were designed for the extraction of honey and tried at different places. Trials were also conducted on the preservatoin of honey by (a) artificial ripening and (b) proper storing.

Appliances for extraction of honey: *The honey press.* This machine was designed after the model of the Scottish heather honey press. The honey is squeezed out by the pressure exerted by a vertical screw-rod with a metal plate attached to its free end. It was tried at Top slip (Thunaccadavu Range) and Onnaithittu (Talamalai Range) and found quite efficient as it was able to squeeze out the last drop of honey from the combs. But the quality was not satisfactory since considerable quantities of pollen, bits of wax and other extraneous matter got forced out along with the honey, thus impairing its flavour, purity and clarity.

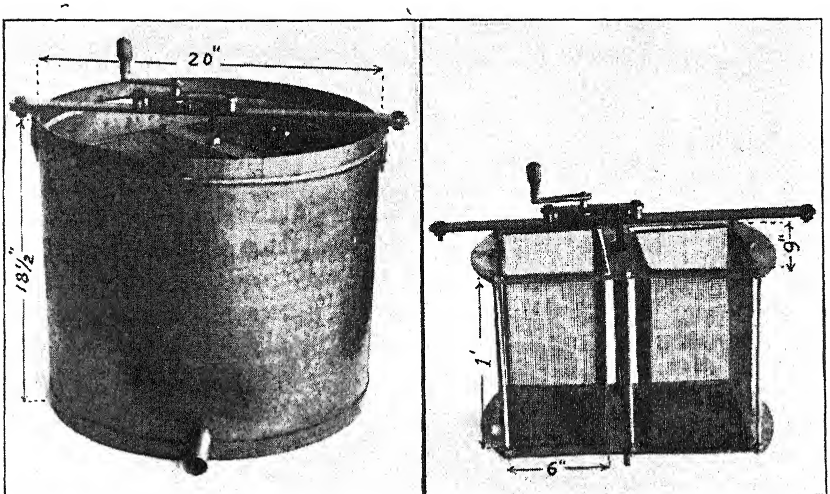
The honey strainer. This consists of two vessels kept one over the other with a thick wire-net (4 meshes for 1") partition between the two. The honey combs were first cut into small bits with a clean knife, scrupulously eliminating the brood portions and as far as possible the pollen bearing cells also. The pieces were then tied in a cloth bag and the bag was kept inside the upper vessel of the strainer, so that the honey may gradually ooze out by mere gravitation. The appliance was used at Top slip and Onnaithittu. At the former place nearly 90 per cent of the honey drained in 3 hours and at the latter 81·5 per cent in 18 hours. The period taken for the honey to drain out obviously depends on its density, which again varies according to the source from which the nectar is collected. Apart from the long time taken appreciable quantities of pollen also came out through the meshes of the

cloth and thus spoiled the quality of the honey. The latter factor is not, however, constant since the degree of admixture depends on the quantity of pollen stored in the combs.

The honey extractor : (plate). This was designed after the model of the honey extractor commonly used for the Indian bee (*A. indica*) with certain modifications. The machine consists of a cylindrical metal drum $1\frac{1}{2}$ ft. in height and 2 ft. in diameter and a box to hold the honey combs. The box is fixed to a rotating rod at its centre and the revolution is affected by the action of a set of gear wheels on the central rod. Two movable wire-gauze cages each 6″ × 9″ × 1″ are provided in the comb box for holding the honey-combs. Whole pieces of honey-combs each measuring about 9″ × 9″ × 6″ and weighing about 4 lbs. each were uncapped, kept inside these cages and the box rotated. The machine was tried at Onnaithittu and Begur (Wynaad) and found quite efficient. Combs weighing about 10 lbs. were worked at a time in the machine and almost the last drop of honey was thrown out in about 10 minutes. The machine was also found capable of extracting the honey even from small pieces of combs. In this connection mention has to be made of the possibility of an admixture of pollen in the honey. The Rock bee does not appear to be clean and regular in its food-storing habits. Considerable quantities of pollen are often found stored in the midst of the honey-bearing portions and in many cases both honey and pollen are found stocked in one and the same cell. In such cases a few pellets of the powdery material also get thrown out along with the drops of honey. Though this defect is inevitable, the undesirable matter can be skimmed off when it generally collects at the top in the form of a scummy layer within about a fortnight after storing. But this difficulty is not met with in cases where there is not much pollen stored in the combs. Of the three appliances tried, the centrifugal honey extractor is considered to be the most efficient for the following reasons:—

1. The honey extracted is untouched by hand.
2. There is no chance of contamination by the grubs and other extraneous matter.
3. Chances for admixture of pollen are much less
4. The process of extraction is much quicker.
5. Honey can be easily extracted from all sizes of combs varying from the biggest pieces to the smallest bit.

Preservation of honey: Ripening. A good sample of honey generally contains about 15 per cent of moisture and any quantity in excess of it may induce fermentation. In nature, when the honey reaches this optimum condition the cells are generally sealed by the bees and the honey inside these cells is said to be "ripe". In the case of the honey combs of the Indian bee the sealed condition or otherwise can be fonud out by frequent examination, but in the case of the rock bee, it can be known only when the bees are driven off and the combs removed. All the honey obtained from the Rock bee



The Honey Extractor and its parts.

colonies cannot therefore, be said to be ripe and under such circumstances the elimination of the moisture by artificial ripening becomes an absolute necessity. The process consists of keeping the honey with the container in hot water for about half an hour, taking care to maintain the temperature of the water steadily at 80° C. Apart from pasteurising the honey and eliminating the superfluous moisture, the process also clears the honey of the undesirable matter contained in it. Only some samples appear to contain the latter material, and in such cases, it collects itself as a scummy layer at the top when the honey is heated and this can be easily removed. Samples of honey collected from the forests were ripened and kept under observation with appropriate controls of untreated material. In all these cases, the latter material began to ferment very soon, thereby indicating that the artificial ripening ensures the keeping qualites of honey.

Storing honey. Honey, whether ripened or not, will absorb moisture from the air and ferment if it is kept carelessly. Due attention should, therefore, be paid to the proper storing of the material. Only scrupulously clean receptacles should be used and those containing honey should be kept properly sealed. In cases where large quantities are handled, honey can be stocked in clean kerosine tins, but care should be taken to seal the lids. Frequent opening of the containers is not desirable and in cases where small quantities of honey have to be taken out frequently, it is better to stock the material in smaller containers such as jam jars.

Drained honey. A certain amount of bad handling and crushing of the combs is inevitable when they are collected. A considerable quantity of the honey drains out in the vessel itself during transit, partly due to the bad handling but mostly due to the pressure exerted by the weight of the combs and this cannot be avoided under any circumstances. An appreciable quantity of brood, bees, as well as other undesirable matter such as lumps of pollen, broken bits of twigs, leaves, pieces of burnt sticks etc. are invariably found floating in this honey. There was nothing wrong with it except for the temporary contamination. It was, therefore collected and *filtered immediately*, ripened and bottled. Special attention should be paid to the promptness with which this honey is filtered and treated, since the dead grubs, pupae and bees that may be floating in the honey are likely to decompose and ruin its quality, if there is any undue delay.

Summary. Of the three machines tried for the extraction of honey the centrifugal honey extractor appears to be the most efficient on account of the thoroughness and quickness of the work and purity of the honey.

Drained honey, also is of good quality, provided all the undesirable, material is removed immediately as suggested already If, in spite of these precautions, the quality is not as satisfactory as that of the extracted honey, the material may be graded as No. II.

strains of heavy yielding varieties of cereals, millets, groundnut, cotton and sugarcane evolved from Government farms, fruits, and industrial products prepared from these, insect pests and plant diseases with remedial and control measures and Bee-keeping formed the main items of the display. The exhibits commanded considerable attention of the ryot classes and elicited interested inquiries. An average attendance of between 800 to 1300 was recorded from the commencement to the termination of the exhibition during a period of 16 days. A practical demonstration of the use of iron ploughs was also given on one of these days.

A. R.

Weather Review—AUGUST 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	20·9	+13·1	63·9	South	Negapatam	0·4	−3·2	6·2
	Calingapatam	10·6	+2·7	36·9		Aduthurai *	2·0	−1·1	12·3
	Vizagapatam	4·5	−0·9	21·0		Madura	6·4	+2·1	19·9
	Anakapalli*	0·0	0·0	0·0		Pamban	0·0	−0·7	11·5
	Samalkota*					Koilpatti*			
	Maruteru*	8·2	+1·2	26·0		Palamkottah	0·1	−0·5	7·1
	Cocanada	5·9	+0·4	28·3					
	Masulipatam	7·6	+0·7	19·1					
	Guntur*	0·0	0·0	0·0	West Coast	Trivandrum	6·8	+2·7	45·8
						Cochin	23·9	+11·0	100·1
Ceded Dists.	Kurnool	6·5	+1·5	18·2		Calicut	26·0	+10·4	106·1
	Nandyal*	7·1	+1·6	13·4		Pattambi *	20·9	+6·1	81·8
	Hagari *	1·8	−2·0	13·5		Taliparamba *	38·9	+14·0	130·9
	Siruguppa*	4·5	+1·0	14·0		Kasargode *	41·9	+18·3	130·5
	Bellary	1·7	−0·6	13·7		Nileshwar*	39·8	+14·3	139·7
	Anantapur	1·3	−0·9	7·0		Mangalore	47·6	+25·1	127·4
	Rentachintala	3·3		15·8					
	Cuddapah	2·7	−3·1	20·8					
	Anantharaju-				Mysore and Coorg	Chitaldrug	2·9	−0·1	16·5
	pet *	4·0	+1·3	17·3		Bangalore	3·1	−2·3	18·8
Carnatic	Nellore	1·0	−2·3	13·8		Mysore	1·7	−1·6	18·7
	Madras	4·0	−0·6	15·2		Mercara	34·0	+8·5	126·5
	Palur *	3·8	−1·3	11·0					
	Tindivanam *	4·6	−0·3	13·8	Hills	Kodaikanal	4·1	−2·9	31·9
	Cuddalore	4·1	−0·9	11·3		Coonoor			
Central	Vellore	3·2	−3·1	13·6		Ootacamund *	5·4	−1·8	30·9
	Salem	2·2	−4·6	22·1		Nanjanad *	5·2	−1·7	31·9
	Coimbatore	0·7	−0·4	15·5					
	Coimbatore A. C. & R. I.*	1·0	−0·2	12·9					
	Trichinopoly	0·6	−3·2	9·9					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The monsoon was generally active over the peninsula, under the influence of four depressions in the Bay of Bengal. The first depression originated as an area of unsettled weather at the head of the Bay on the 1st and developing into a storm crossed the South Bengal coast on the 2nd and 3rd and finally disappeared over the United Provinces on the 11th. The second depression appeared off the Circars Orissa coast on the 12th and moving inland merged into the seasonal low

by the 15th. The third depression appeared as a low off the Orissa coast on the 7th and developing into a depression by the 21st off Puri, passed inland on the next day and disappeared over Central India by the 25th. The fourth depression appeared about 100 miles south east of Calcutta on the 26th and moving inland, disappeared by the 31st of the month.

Rainfall was particularly heavy on the West Coast of the peninsula between the 10th and the 14th and on the Circars-Orissa coast between the 17th and 22nd during the passage inland of the third depression.

Rainfall was in large excess in parts of the Circars, and West Coast, and in slight excess in the Ceded Districts, nearly normal in the Carnatic and below normal elsewhere.

The chief reports of heavy rainfall in 24 hours were :
Mangalore 4·1" (10th); 6·5" (12th) and 4·5" (13th);
Cochin 4·1", Irinjalakuda (Cochin) 8·9";
Peermade (Travancore) 6·4"; Cranganore (Cochin) 6·3";
Kasargode 6·4" and Ankamalli (Travancore) 7·0" (all on the 14th).
Narasapur (W. Godavary) 6·5" and Jeypore (Ganjam) 5" (on the 17th).
Gopalpore 9·0" (21st) and 4·2" (22nd).

Weather Report for the Agricultural College and Research Institute Observatory.

Report 8/40.

Absolute maximum in shade.	...	91·5°F
Absolute minimum in shade.	...	68·0°F
Mean maximum in shade.	...	86·9°F
Departure from normal.	...	nil.
Mean minimum in shade.	...	71·9°F
Departure from normal.	...	+0·8°F
Total rainfall for the month.	...	0·99"
Departure from normal.	...	– 0·20"
Heaviest fall in 24 hours.	...	0·34" on the 13th.
Total number of rainy days.	...	3
Mean daily wind velocity.	...	5·4 m. p. h.
Departure from normal.	...	– 1·6 m. p. h.
Mean humidity at 8 hours.	...	72·3%
Departure from normal.	...	– 1·7%

Summary. The weather conditions were slightly unsettled during the 1st half of the month when a total rainfall of 0·99" was recorded. The rainfall was in defect by 0·2". Skies were moderately to heavily clouded and the humidity was in slight defect. The mean maximum temperature was normal while the mean minimum was slightly above normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Appointment.

Sri. L. Narasimha Acharya, Agricultural Demonstrator, Chittoor is appointed to officiate as Assistant Director of Agriculture in Category 6, class 1 Madras Agricultural Service and is posted to Bellary vice Sri. R. N. K. Sundaram appointed as Deputy Director of Agriculture, II Circle, Cuddapah.

Transfers.

Name of officers.	From	To
Sri. R. Chokkalingam Pillai,	Asst. D. A., (on leave)	Asst., D. A., Tinnevelly
,, V. T. Subbayya Mudaliar	Offg. Asst. D. A., Tinnevelly.	Offg. Asst. D. A., Bellary.

Subordinate Services.

Transfers.

Name of officers.	From	To
Mr. Syed Ibrahim Sahib	F. M., A. R. S, Kodur	A. R. S., Hagari.
,, S. Suryanarayana,	A. D., Kirlampudi,	Special duty at Sugar Factory, Vuyyuru.
,, G. L. Narasimha Rao,	Asst. A. D., Vuyyuru Sugar Factory,	Special duty under the Sugar-cane Growers' Union, Kirlampudi.
,, V. N. Subbannacharya	A. D., (on leave)	A. D., Rayadrug.
,, D. Satyanarayan,	F. M., A. R. S., Anakapalle	A. D., Challapalle.
,, N. Krishna Menon,	Sub-Asst. in Entomology, Coimbatore,	Special duty, Vadavanur.
,, R. Krishnamurthi,	A. D, Saidapet,	F. M. Nandyal.
,, M. P. Narasimha Rao,	A. D, (on leave),	Asst. in Cotton. Guntur.

Leave.

Name of officers.	Period of leave.
Sri T. K. Balaji Rao, A. R. S., Aduthurai	L. a. p. for 3 months from 5—8—40.
,, R. Krishnamurthi, A. D., Saidapet	Extension of l. a. p. on m. c. for 1 month from 24—8—40.
,, R. Guruswami Naidu, A. D., Kaikalur	Extension of l. a. p. for 45 days from 31st August 1940.
,, J. Suryanarayana, A. D., Gurzala	L. a. p. on m. c. for 3 months from 19—8—40.
,, S. Kuppuswami Ayyangar, A. D., St. Thomas Mount	Extension of l. a. p. for 2 months from 26—8—40.
,, M. P. Sankaran Nambiar, A. D, Dharapuram	L. a. p. for 3 months and 15 days from 9—9—40.
,, A. G. Ramaswamiah, Sub-Asst. in Entomology, Coimbatore	Extension of l a. p. on m. c. for 2 months from 6—9—40.
,, P. Vishnusomayajulu, Asst. in Mycology. Coimbatore	L. a. p. for 1 month from 9—9—40.
,, K. M. Jacob, A, D., (on leave)	Extension of leave on half average pay on m. c. for 2 months from 11—9—40.
,, C. S. Namasivayam Pillai, A. D., Nanguneri	L. a. p. on m. c. for 2 months from the date of relief.
,, E. Kunhappa Nambiar, Permanent Upper Subordinate and Assistant Director of Agriculture, St. Thomas Mount.	L. a. p. for 2 months with effect from the 5th September or the date of relief.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVIII.] OCTOBER 1940 [No. 10

EDITORIAL

Export of Sugar. A press communique recently issued by the Government of India stated that the application made for the partial release from their obligations, under the International Sugar Agreement so as to enable India to export to the United Kingdom up to 200,000 tons of sugar during the year ending 31st December, 1940, has been granted. Early in the year, the Indian Sugar Syndicate carried out negotiations with the British Ministry of Food for exports of Indian Sugar to Britain but these negotiations failed owing to disagreement over the price. It was then stated that the industry was prepared to sell a portion of the surplus stock estimated at over two lakh tons at reduced prices, if the Government of India offered certain concessions in regard to railway freights and excise duty. As these concessions were not forthcoming the whole transaction fell through. We are, however, glad to learn that the Syndicate at an extraordinary meeting held on 22nd October, 1940 in view of the export facilities accorded, appointed a committee to meet the Government representatives and negotiate the terms of an agreement. We wish the forthcoming meeting the success it deserves. The United Kingdom, imports over two million tons of sugar annually from outside. It should be possible for her to buy at least a portion of her requirements from India, a member of the British Empire. This will certainly give an outlet for the surplus stock now available in India and place her sugar industry on a firm basis. It is our sincere hope that the special facility now extended to India will, in course of time, lead to a permanent agreement of mutual benefit to the countries.

Tobacco Marketing. The report issued by the Agricultural Marketing Adviser to the Government of India on the marketing of tobacco in India reveals several points of interest to the Indian grower. India produces about one fourth of the world's tobacco and further many well known brands of cigarettes are manufactured in India for which large quantities of locally grown tobacco are used. More than half the Indian production is concentrated in five clearly defined zones viz., the North Bengal and North Bihar for production of *hookah* and other types of tobacco, the *charotar* area in Gujaret along with that of Nipani in the South of the Bombay Presidency have a special reputation for their *bidi* tobaccos, while Guntur is outstanding for the production of high class cigarette leaf. The wholesale value of all

constitutes, therefore, an important source of ready cash to the cultivators. In the Guntur district about two-thirds of the area is now under Virginia types of tobacco which yield on an average about 750 lbs. of raw leaf or about 400 – 500 lbs. of processed leaf per acre.

The largest volume of the international trade consists of flue-cured tobacco for which the demand is steadily increasing. The total production of this type in India, is reported to be only about 2 per cent of the total.

There is a certain amount of satisfaction to be found in the fact that imports of cigarettes into India have shown a more than corresponding decrease. The *per capita* consumption in Madras is reckoned to be only 10 cigarettes per annum. The general trend of tobacco consumption in India is upward particularly in the case of cigarettes. It is essential that in those areas considered suitable for the production of Virginia cigarette tobacco, the growers should realise the great importance of quality and continue their efforts to improve it. That there is ample scope for expanding the market for high quality Indian tobacco is clear from the progress made in recent years in the Guntur district. The high quality of the cured Virginia produced there, is continuing to displace American leaf imported for cigarette making. Statutory grades for cigarette leaf have already been prescribed under the Agricultural produce (grading and Marking) Act, 1937, which define the grades on the basis of colour, texture and freedom from blemish. It is interesting to note that although standard grades have only been in operation for cigarette tobacco in the Guntur area for less than two years, there is already a large body of opinion amongst growers, merchants, exporters and manufacturers that it would be to the advantage of all if steps could be taken to ensure that all cigarette tobacco grown and exported from that area could be graded and marked in accordance with the provisions of the Agricultural Produce (Grading and marking) Act. On an average, of the prices realised for Virginia flue-cured tobacco (stripped) in the United Kingdom markets, the grower from Guntur is estimated to get about 42·3 per cent for his leaf, while the exporter's margin amounts to 16 per cent. The balance viz. 41·7 per cent represents loss in moisture, stripping charges on grading, packing, transport, insurance, landing charges, rent, brokerage, marketting etc. In 1923, there were only 11 cigarette factories in India while in 1935 the number increased to 22. The annual production of cigarettes in India, is estimated at about 7,500 million cigarettes valued at nearly six crores of rupees. It is clear from the report that there is still considerable scope for increasing the cultivation of the Virginian type of tobacco. We hope the cultivators will take advantage of the situation and extend the area. Like sugar, cotton and cement industry, considerable progress can be expected from tobacco industry in the course of a few years, provided the crop is tackled in the right direction in all stages, cultivation, marketing and manufacture.

Rock Bee Honey, its Extraction and Preservation.

By M. C. CHERIAN, B. A., B. Sc., D. I. C.

and

S. RAMACHANDRAN, L. Ag.

Agricultural Research Institute, Coimbatore.

Introduction. The Rock bee *(Apis dorsata,)* has been the main source of honey in India from time immemorial, though the quality of the material available to the public was poor. The recent introduction of modern methods of beekeeping and their rapid spread in this presidency have revolutionised the popular notion about pure honey. Machine-extracted honey from the domesticated Indian bee *(Apis indica,)* always fetches a good price, while Rock bee honey is not so popular on account of its impure and sometimes fermented condition when it reaches the consumer. A study of the existing methods of honey extraction and preservation was therefore taken up and the possibilities of improvement explored. The present paper contains a short account of the trials conducted and the results obtained, therefrom.

The Rock bee. Before giving the details of these trials, a short description of the Rock bee and its peculiar habits will not be out of place here. Of the four indigenous honey bees, viz., the Rock bee, the Indian bee, the Little bee and the Dammar bee, the first one is the biggest in size. Its favourite haunts are hilly and forest areas, mostly above 2000 feet elevation, but stray colonies are often found on the plains also. Swarms of this bee establish themselves in the open in inaccessible places such as precipitous cliffs and over-hanging rocks, branches of tall trees, etc. Occasionally 50 to 60 colonies are found on a single tree. The combs are built singly and very often reach three feet in length and about two feet in breadth. The top portion of the comb is about nine inches where honey and pollen are stored bulges out to a width of about six inches. The brood is reared in the lower portion. This bee is a very good honey-gatherer and a strong colony may yield up to 40 lbs. In spite of its good honey-gathering qualities, this bee has, unfortunately, a few undesirable traits which render it unfit for domestication. The single comb building habit, necessitates the destruction of the brood while extracting honey. This unnecessary destruction of life and crushing of the comb is against the very fundamentals of scientific beekeeping. On the other hand the Indian bee constructs a series of parellel combs and invariably stores honey separately from the brood. Under domesticated conditions the honey combs can be easily taken out for extraction of honey and the empty combs given back without disturbing the normal working of the colony. Secondly the Rock bee is easily irritable and vindictive when provoked. It has been reported that men and domestic animals are sometimes stung to death. Lastly this bee is migratory in habits; visiting the hills during the summer months and moving down to the lower elevations after the outbreak of the

monsoon. The domestication of this bee, therefore, seems to be out of question and only better methods of extraction and preservation of honey can be suggested.

Existing methods of honey extraction and preservation. The handling of these bees and the collection of honey and wax are exclusively done by the jungle tribes. They know by experience the seasons of honey flow and the combs are taken only when they are sure that a good quantity of honey has been stocked in them. As a general rule the colonies are handled only after night fall. The ingenuity, coolness and daring exhibited by these "children of the forest" while approaching colonies of these dangerous insects are simply amazing. Before beginning the work, they fortify themselves against any accident or attack by the bees by a preliminary "puja" to propitiate the jungle dieties. In cases where colonies of the bees have established themselves under overhanging rocks, the approach often extends to a few hundred feet over the steep precipices, a slip from which would mean loss of life. The equipments required for approaching the colonies and collecting the honey are a few lengths of forest canes tied together with jungle fibre or a sufficient length or strong fibre rope, a kerosine tin open at the side and slung to a long rope and the inevitable smoking torch. One end of the cane or rope is well secured to a tree at the top and the man gets down to the work spot with the help of this improvised ladder. The task appears to be comparatively easier, in cases where the colonies are found on trees; as the men easily climb up even to the dizzy heights at which the colonies are found. When there are a number of colonies on different branches of the same tree, they move from branch to branch with the help of bamboos tied across them. The crowning feat of their admirable skill and daring lies in the fact that all this work is done in pitch darkness. When they have to tackle a larger number of colonies they are able to camp the whole night either under the rocks or on the top of the trees.

Regarding the collection of the honey, the bees are first brushed aside with the smoking torch. The brood portion is then broken off and sent down in the kerosine tin. The empty tin is sent up again to get the honey comb. It takes only about 5 to 10 minutes to tackle each colony.

The brood combs are sometimes boiled and eaten by the jungle tribes but the bulk of them is kept for wax extraction. The honey combs are then taken and the small bits of brood that may be still adhering to them are removed. The honey is then squeezed out with the hand and is either handed over to the contractors immediately or sold locally. No attempts are made to store the honey. It is needless to add here that the methods are thoroughly unclean and the quality of honey very poor on account of the admixture of considerable quantities of pollen and possibly some brood-juice as well. Till recently the Forest Department were leasing out the right of collecting honey and wax. Realising the possibilities of improving

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monsoon. The domestication of this bee, therefore, seems to be out of question and only better methods of extraction and preservation of honey can be suggested.

Existing methods of honey extraction and preservation. The handling of these bees and the collection of honey and wax are exclusively done by the jungle tribes. They know by experience the seasons of honey flow and the combs are taken only when they are sure that a good quantity of honey has been stocked in them. As a general rule the colonies are handled only after night fall. The ingenuity, coolness and daring exhibited by these "children of the forest" while approaching colonies of these dangerous insects are simply amazing. Before beginning the work, they fortify themselves against any accident or attack by the bees by a preliminary "puja" to propitiate the jungle dieties. In cases where colonies of the bees have established themselves under overhanging rocks, the approach often extends to a few hundred feet over the steep precipices, a slip from which would mean loss of life. The equipments required for approaching the colonies and collecting the honey are a few lengths of forest canes tied together with jungle fibre or a sufficient length or strong fibre rope, a kerosine tin open at the side and slung to a long rope and the inevitable smoking torch. One end of the cane or rope is well secured to a tree at the top and the man gets down to the work spot with the help of this improvised ladder. The task appears to be comparatively easier, in cases where the colonies are found on trees; as the men easily climb up even to the dizzy heights at which the colonies are found. When there are a number of colonies on different branches of the same tree, they move from branch to branch with the help of bamboos tied across them. The crowning feat of their admirable skill and daring lies in the fact that all this work is done in pitch darkness. When they have to tackle a larger number of colonies they are able to camp the whole night either under the rocks or on the top of the trees.

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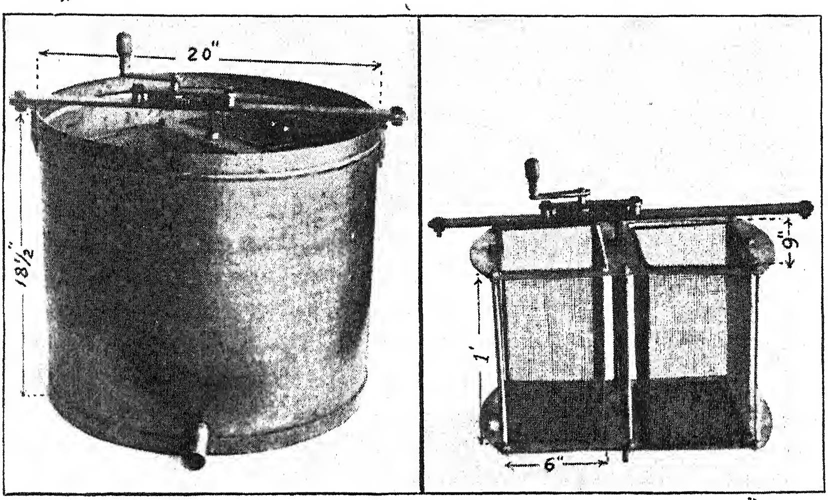
cloth and thus spoiled the quality of the honey. The latter factor is not, however, constant since the degree of admixture depends on the quantity of pollen stored in the combs.

The honey extractor : (plate). This was designed after the model of the honey extractor commonly used for the Indian bee (*A. indica*) with certain modifications. The machine consists of a cylindrical metal drum $1\frac{1}{2}$ ft. in height and 2 ft. in diameter and a box to hold the honey combs. The box is fixed to a rotating rod at its centre and the revolution is affected by the action of a set of gear wheels on the central rod. Two movable wire-gauze cages each 6″ × 9″ × 1″ are provided in the comb box for holding the honey-combs. Whole pieces of honey-combs each measuring about 9″ × 9″ × 6″ and weighing about 4 lbs. each were uncapped, kept inside these cages and the box rotated. The machine was tried at Onnaithittu and Begur (Wynaad) and found quite efficient. Combs weighing about 10 lbs. were worked at a time in the machine and almost the last drop of honey was thrown out in about 10 minutes. The machine was also found capable of extracting the honey even from small pieces of combs. In this connection mention has to be made of the possibility of an admixture of pollen in the honey. The Rock bee does not appear to be clean and regular in its food-storing habits. Considerable quantities of pollen are often found stored in the midst of the honey-bearing portions and in many cases both honey and pollen are found stocked in one and the same cell. In such cases a few pellets of the powdery material also get thrown out along with the drops of honey. Though this defect is inevitable, the undesirable matter can be skimmed off when it generally collects at the top in the form of a scummy layer within about a fortnight after storing. But this difficulty is not met with in cases where there is not much pollen stored in the combs. Of the three appliances tried, the centrifugal honey extractor is considered to be the most efficient for the following reasons:—

1. The honey extracted is untouched by hand.
2. There is no chance of contamination by the grubs and other extraneous matter.
3. Chances for admixture of pollen are much less
4. The process of extraction is much quicker.
5. Honey can be easily extracted from all sizes of combs varying from the biggest pieces to the smallest bit.

Preservation of honey: Ripening. A good sample of honey generally contains about 15 per cent of moisture and any quantity in excess of it may induce fermentation. In nature, when the honey reaches this optimum condition the cells are generally sealed by the bees and the honey inside these cells is said to be "ripe". In the case of the honey combs of the Indian bee the sealed condition or otherwise can be fonud out by frequent examination, but in the case of the rock bee, it can be known only when the bees are driven off and the combs removed. All the honey obtained from the Rock bee



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colonies cannot therefore, be said to be ripe and under such circumstances the elimination of the moisture by artificial ripening becomes an absolute necessity. The process consists of keeping the honey with the container in hot water for about half an hour, taking care to maintain the temperature of the water steadily at 80° C. Apart from pasteurising the honey and eliminating the superfluous moisture, the process also clears the honey of the undesirable matter contained in it. Only some samples appear to contain the latter material, and in such cases, it collects itself as a scummy layer at the top when the honey is heated and this can be easily removed. Samples of honey collected from the forests were ripened and kept under observation with appropriate controls of untreated material. In all these cases, the latter material began to ferment very soon, thereby indicating that the artificial ripening ensures the keeping qualites of honey.

Storing honey. Honey, whether ripened or not, will absorb moisture from the air and ferment if it is kept carelessly. Due attention should, therefore, be paid to the proper storing of the material. Only scrupulously clean receptacles should be used and those containing honey should be kept properly sealed. In cases where large quantities are handled, honey can be stocked in clean kerosine tins, but care should be taken to seal the lids. Frequent opening of the containers is not desirable and in cases where small quantities of honey have to be taken out frequently, it is better to stock the material in smaller containers such as jam jars.

Drained honey. A certain amount of bad handling and crushing of the combs is inevitable when they are collected. A considerable quantity of the honey drains out in the vessel itself during transit, partly due to the bad handling but mostly due to the pressure exerted by the weight of the combs and this cannot be avoided under any circumstances. An appreciable quantity of brood, bees, as well as other undesirable matter such as lumps of pollen, broken bits of twigs, leaves, pieces of burnt sticks etc. are invariably found floating in this honey. There was nothing wrong with it except for the temporary contamination. It was, therefore collected and *filtered immediately*, ripened and bottled. Special attention should be paid to the promptness with which this honey is filtered and treated, since the dead grubs, pupae and bees that may be floating in the honey are likely to decompose and ruin its quality, if there is any undue delay.

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Drained honey, also is of good quality, provided all the undesirable, material is removed immediately as suggested already If, in spite of these precautions, the quality is not as satisfactory as that of the extracted honey, the material may be graded as No. II.

There is danger of soil erosion when new irrigation projects are executed, particularly in country with a steep slope. The area of the proposed Tungabhadra project is an example. There is special work being done at the Hagari Agricultural Research Station to deal with soil erosion that irrigation in Bellary and other Ceded Districts may produce.

In all these cases, the root cause of the trouble is a lack of balance between what the soil can sustain and what the population demands from it —whether from an increase of numbers or an increase in their standard of living or both. While science can increase the returns from soil by the application of improved physical, chemical and biological methods, there seems to be a limit to the population and the standard of living which the soil resources of a country can sustain. There is indeed a need for a third major formula in Agro-biology which indicates the maximum crop that can be sustained during any length of time even by perfectly fertile soil. It is perhaps a recognition that such a boundary exists that is the secret of long sustained civilizations like India and China. It has been calculated by Agro-biologists that rice is the one crop that can maintain the largest population per square mile. Wisdom in agriculture is apparently part of the essential basis of a harmonious civilization.

It is therefore the task of agricultural scientists not only to teach us to get more from soil when we do not get enough but also to be restrained in our demands on soil and its fertility so that our life and civilization may not be a brief flash but a steady light shining through time. In such a task, I wish the Madras Agricultural Students' Union all success in taking its due share.

List of Prize Winners.

1.	The Robertson prize	E. Jaganatha Rao.
2.	The Clogstoun prize	L. Venkataratnam.
3.	The Keess prize	E. V. J. Cunha.
4.	The Sampson prize	L. Venkataratnam.
5.	The Dewan Bahadur R. Raghunatha Rao prize	M. Ramiah.
6.	The D'Silva Memorial prize	G. Rama Rao.
7.	The Goschen prize	G. Rama Rao.
8.	The Anstead prize	P. Venkateswara Rao.
9.	Rao Bahadur K. S. Venkatarama Ayyar prize	K. N. Doraiswami. C. Sankar Rao.
10.	The Dewan Bahadur L. D. Swamikannu Memorial prize	K. Bhaskaram.
11.	The Certificate course cup	G. Rama Rao.
12.	The Old Cuddapah District Agricultural Association prize	C. Sankar Rao, B. Sc. I N. Bhaskar Reddy, B. Sc. II B. Narayana Reddy, B. Sc. III
13	The Gupta prize	B. Narasimham.
14.	The M. K. Nambiar Memorial prize	G. Rama Rao.

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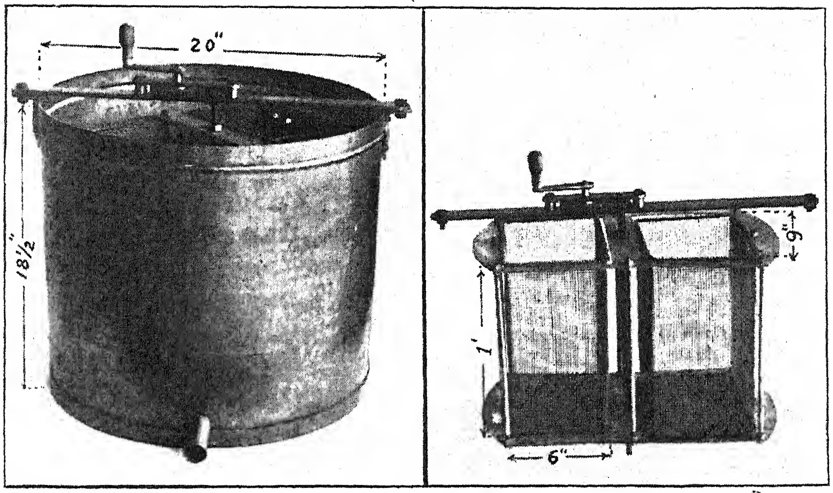

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Artificial ripening of honey is an absolute necessity, as it is the only method to prevent fermentation and subsequent deterioration of the material.

Equal attention should be paid to the proper preservation of honey.

Acknowledgements. Our thanks are due to the District Forest Officers Coimbatore North, Coimbatore South and Wynaad for the excellent facilities provided by them for conducting the trials and the Research Engineer, Agricultural College, for kindly making the necessary appliances in his work-shop.

The Cultivation and Marketing of Roses at Iquaripalayam village.

By K. V. NATESAN, B. Sc. (Ag.),

Superintendent, Groundnut Market, Tindivanam.

Introduction. It is a known fact that there is a continuous and growing demand in all urban areas for roses among other flowers, throughout the Presidency. Many villages near such areas grow this crop on a field scale and Iquaripalayam is one such village. Roses fetch to its producers, the ready money to meet their house-hold and other day-to-day expenses. This village consists of nearly 100 homes and is situated about six miles, from Gummidipundi R. S. on the Madras—Culcutta line and is about 36 miles, from Madras by road. The total area of the village is about 1,000 acres, of which only 500 acres, are cultivable. The village has a tank with a very good water supply lasting for 6 to 9 months in a year, from August till April following. The ryots who cultivate roses belong chiefly to the Kshatriya caste, though a few Vysias and Adi-Dravidas also grow them.

The Land. There are nearly 40 acres now under roses in this village. It is cultivated in both wet and garden lands but more in the wet lands. The soil is light red, sandy loam to clay loam and homogeneous to a depth of 8 to 10 feet. It is surprising to see a rose garden coming up well between plots of wet paddy, with stagnant water all round. Even though the fields round about are wet, the plots where roses are grown, are not at all miry. I was told that even in rainy season water does not stagnate in these plots and that it could be easily drained if necessary, within a few hours. The water table is nearly 4 feet from the ground level during the wet months and 10 to 12 feet in summer. Even so, the plants in garden lands produce more flowers than in wet lands during the rainy months as the wet plots do not dry up soon; and again the plants in loamy soils produce more flowers than plants in light sandy or clay loams. But much depends upon the care that is bestowed on the plants.

Season. The usual season when roses are planted in this village is etween September and January, but plantings in September and December,

when rainfall is not heavy, come up better than October and November plantings.

Preparation of Land. Ryots begin preparatory cultivation by about the beginning of August with the help of the early showers, and usually four ploughings are given with a country plough. Lines are marked with the help of ropes at intervals of $4\frac{1}{2}$ feet each way.

Seeds and Planting. Well rooted layers about 2,000 for an acre, are planted at the junctions of these lines. A few extra cuttings are planted in a nursery to replace the failures. About 5 per cent. of the plants might fail to establish if the planting is done in September or December, while in the other two months, the casualities are much more. The plants are pot-watered as soon as they are planted. Thereafter, they are irrigated once in three days till they establish, i. e., for about a fortnight. Subsequent irrigations are given once a week if no rain is received. About 60 days after planting, the well-established plants begin to flower, and it is not unusual that from 100 to 200 flowers are got from a plot of one acre in the first picking. From this time onwards, a few hundreds of flowers are got almost every day depending upon the amount of care put in.

Manures and Manuring. The first manuring is done about a month after planting and for this, about 2 cartloads of farm-yard manure are considered sufficient. After this, 10 cartloads of farm yard manure are applied once in every six months. Each plant receives nearly 5 lb. of manure at the base of the plants close and round it. The manure is not applied to the entire field. After the first year, the plants receive two manurings, once in August and again in November at 10 cartloads of farm yard manure per acre.

After cultivation. This is very important in the cultivation of roses. Almost once in 40 days the fields receive a good hoeing with mammaties and weeds are removed. No labour-saving implement is used for the purpose owing to the thorny nature of the plants. About 10 to 12 men working for a day, easily cover an acre, hoeing with mammaties, About 7 to 8 hoeings in a year on an average per acre are not unusual. Soon after manuring in November, a good weeding is done and the matured branches are layered. After the layering, new shoots sprout up from the bent branches, which take nearly 40 days to come to flower. This is done in the middle of November so as to get the new shoots into full bearing by the end of December when the price of flowers at Madras city is high.

Irrigation. The plants receive nearly 4 to 5 irrigations per month in the hot months and less during the rainy months so that about 35 to 40 irrigations are given per year. The tank which supplies water for nearly nine months in the year is very handy to the ryots and no difficulty is felt by any to let in the tank water. Water is freely used and fields are often flooded. Those who have wells, irrigate their rose garden during May, June and July when the tank is empty, but others leave the plants to nature.

The crop so left does not die as it is sustained by the light showers received during these months. In fields left dry during the summer months, layers made previously fail to come up successfully and naturally the owners lose some part of their income from the extra flush resulting from new shoots and the sale of rooted cuttings.

Yields. As already said, planting is usually done in September. The plants strike roots and come to flowers in about 60 days and yield as much as 100 to 200 flowers per acre daily. There is a gradual increase in the number of flowers as the plants begin to grow and put on new shoots. During the first year from January to December, as much as 80,000 flowers are obtained from an acre and in the second, third and subsequent years, the yield increases to about 3 to 5 times that of the first year. By the 7th or the 8th year the plants would have become too stumpy and old and the yield of flowers goes down.

TABLE I. Statement showing the number of flowers obtained and amount realised by a ryot from a plot of 75 cents during the first year from January to December.

Month	No. of flowers 0·75 ac.	Calculated to an acre.	Amount realised by sale (0·75 ac.)			Calculated amount for an acre.		
			Rs.	a.	p.	Rs.	a.	p.
January	650	867	1	3	7	1	10	1
February	1,845	2,460	0	13	10	1	2	5
March	6,095	8,127	4	2	10	5	9	1
April	11,630	15,507	12	3	4	16	4	5
May	4,225	5,633	5	0	3	6	11	0
June	—	—	—	—	—	—	—	—
July	1,285	1,713	1	6	2	1	13	7
August	11,015	14,687	7	10	7	10	3	5
September	4,340	5,787	9	4	1	12	5	5
October	5,255	7,007	5	6	5	7	3	3
November	3,630	4,840	3	9	1	4	12	1
December	9,250	12,333	10	2	10	13	9	1
Total	59,220	78,960	60	15	0	81	3	10

The amount shown as realised by the ryot is after deducting all expenses in marketing, i. e., the actual amount received by him at the end of every month. The above statement shows in round figures that about 80,000 flowers worth about Rs. 80 per acre would be the average production and income in the first year of the rose cultivation. From the cost of cultivation of which details are appended it is clear that the ryots do not gain anything in the first year as the income is less than the expenses. It is only from the second year when the plants begin to yield more flowers and the cultivation expenses are low that the ryot gets more profit which ranges from Rs. 150 to Rs. 200 per acre. Actual study of production made in a separate garden is given in Table II.

Marketing. This is the most important item in the cultivation of roses. Quick despatch, ready market and co-operation among the growers in marketing are very essential as the flowers cannot last longer than 12 hours after harvest. A ready market is found in Madras city which is only

36 miles from this village. Flowers like this could be cultivated only in villages which are within quick reach of big city markets and where the flowers could be sold without difficulty. Otherwise there is every likelihood of the ryots losing a great amount unless other means of disposal like manufacture of *Gulkandu*, rose water etc. are found. The following details will be of some help to persons who intend growing roses near big cities.

At Iquaripalayam there are as many as 106 cultivators who grow rose in nearly 40 acres. They have formed themselves into 10 groups, each with a chief of its own, and with membership consisting of 20, 25, 17, 19, 10, 2, 4, 3, 1 and 5 ryots respectively.

Picking commences by 4 a. m in good flowering season and by 5 a. m. in other seasons and the flowers are delivered to the chiefs before 6 a. m. each day. The flowers supplied by each ryot are counted by the chief rejecting a few insect-attacked or otherwise damaged ones and the total number accepted is noted by him in his accounts and also in the daily supply book of the ryot.

A man is engaged to carry the flowers to Gummidipundi R. S. on a monthly wage of Rs. 4. He is expected to carry 10,000 flowers in light baskets made of coconut leaves. Anything over this number is packed separately and sent through a casual labourer. Similarly, all the chiefs arrange for the despatch of their flowers from the village by 6 a. m. to the railway station where they are received by 7-30 a. m.

Two men are collectively engaged by the 18 chiefs to take the flowers to Madras city for sale. These two persons are provided with season tickets to Madras and they are paid Rs. 4 per month. These men receive the baskets delivered by the chiefs at the railway station and they are counted and weighed and a receipt is taken from the railway authorities for transit to Basin Bridge Junction where the baskets are unloaded and taken to Flower Bazaar. Extra labour is engaged when the total number of flowers exceeds 20,000 on any day. These two persons have each a standing permanent advance of Rs. 2 with them. Railway freight, cooly charges, etc. paid by them on any day is met from this money and recouped from the middlemen merchants at Madras city.

There are four middlemen in Madras city who arrange for the sale of flowers received from Iquaripalayam village All the flowers received from the village are not given to one middleman. The baskets from the various chiefs are handed over to their respective middlemen who arrange for the disposal of the flowers at the prevailing market price. A certain portion of the flowers is rejected by them as by the time they receive the baskets, i. e. 10 a. m, some flowers would have withered, got damaged or shed their petals. On an average about 10 per cent of the flowers received get rejected in this manner. These middlemen hand over a chit each day showing the details of flowers received, quantity rejected, quantity sold, price at which the flowers were sold, the amount due to the chief from them and also the empty baskets of the previous day. The two men return to the

village by 4 p. m. and hand over the chits of the middlemen to the respective chiefs, who make entries in their books. A specimen copy of the chit is given below :—

Dated 8–3–38.

Duplicate copy of chit retained with middlemen.

Name : Muthunagaraja.
Flowers received : 2805
Details of sale :—

400	@ Rs. 0—2—0	...	Rs. 0—8—0
1900	@ „ 0—1—6	...	„ 1-12—6
505	Rejected		2—4—6
2805			
	Cooly charges, railway freight paid	...	
	Amount due ...	...	Rs. 2—4—6

The total amount due to the chiefs, is paid before the 10th of every month deducting a commission of Rs. 0—1 - 6 in every rupee. The common expenses of the 10 chiefs, viz., the value of two season tickets, railway freight paid and cooly charges from Basin Bridge to Flower Bazaar, are proportionately divided according to income derived for the month on the sale of flowers.

The chief is paid a small remuneration of Rs. 4 a month for maintaining accounts and organising the sales. He has to work out at the end of the month the total quantity of flowers despatched, the percentage of reduction, the rate per 100 flowers for the month after deducting all expenses and also calculate the amount due to every ryot supplying flowers to him. Sometimes advances of Rs. 100 or more are got from middlemen for household or other expenses without interest. This guarantees the middlemen a continuous supply of flowers for sale through him till the advances are recouped.

Prices. The daily market rate varies according to supply and demand. The prices, for example, in December and January, are much higher than those during other months ; on the New Year's Day especially flowers are sold at even Re. 1 to Rs. 1—8—0 per 100.

The statement below shows the average monthly price of 100 flowers from January 1932 to December 1937.

Month.	1932	1933	1934	1935	1936	1937
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
January	0 4 0	0 3 6	0 2 8	0 3 3	0 2 6	0 3 3
February	0 4 0	0 3 9	0 3 0	0 1 1	0 1 8	0 0 10
March	0 4 6	0 3 0	0 1 9	0 1 11	0 1 9	0 1 2
April	0 4 0	0 2 0	0 1 8	0 1 3	0 1 2	0 1 9
May	0 2 6	0 2 0	0 2 1	0 2 2	0 1 11	0 2 0
June	0 3 6	0 3 0	0 3 0	— — —	0 2 3	0 3 8
July	0 3 6	0 2 6	0 1 11	0 2 3	0 1 8	0 1 10
August	0 5 0	0 2 3	0 2 6	0 3 9	0 2 7	0 1 2
September	0 4 3	0 3 0	0 3 0	0 1 2	0 3 4	0 3 9
October	0 6 6	0 3 0	0 5 0	0 3 1	0 2 6	0 1 9
November	0 3 6	0 2 6	0 2 5	0 3 0	0 2 2	0 1 9
December	0 7 5	0 3 2	0 2 3	0 2 0	0 1 8	0 2 0
Average	0 4 5	0 2 10	0 2 8	0 2 4	0 2 1	0 2 1

TABLE II. Statement showing the number of flowers obtained and the net income of Mr. Lakshmana Raja from $1\frac{1}{2}$ acres of roses for six years.

Month	1932		1933		1934		1935		1936		1937	
	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income.	No. of flowers.	Net income,	No. of flowers.	Net income.	No. of flowers.	Net income.
		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.
January ...	1600	4 0 3	13600	24 11 0	30670	42 15 0	12245	21 10 2	10690	13 5 9	9570	17 14 2
February ...	2850	7 2 0	6367	15 8 5	26650	41 7 8	68445	40 12 6	11055	9 10 9	75560	35 6 8
March ...	4974	12 3 6	20280	33 13 6	55090	53 0 4	30720	33 7 9	18616	17 8 10	26445	18 2 0
April ...	9150	18 8 3	20565	22 8 0	37115	36 5 6	57560	41 13 2	20365	13 15 4	31885	33 7 8
May ...	4400	5 8 0	16975	16 12 0	16910	20 7 7	24985	31 2 0	15695	17 13 9	25760	30 9 6
June ...	1092	2 6 0	2665	4 4 3	1610	3 0 10	—	—	4780	6 1 10	3765	7 5 4
July ...	671	1 4 8	800	1 4 0	14885	16 6 6	13835	18 7 9	11435	9 9 9	4500	4 13 6
August ...	3405	10 7 6	23220	27 0 10	11930	17 6 0	5155	10 15 11	11745	17 7 1	50955	35 4 9
September ...	3195	8 7 9	19145	30 8 3	18280	31 8 0	70490	47 4 7	3070	5 14 2	5385	11 7 9
October ...	568	2 4 10	4795	7 10 3	5850	16 1 5	19920	34 8 8	16035	23 8 10	8725	8 15 6
November ...	5213	11 6 5	9840	13 1 0	27715	38 8 3	2565	4 5 3	25680	31 15 10	34180	33 10 3
December ...	2837	11 9 1	31530	50 11 4	33090	40 15 2	34200	38 14 5	18740	18 2 6	16970	18 10 8
Total for $1\frac{1}{2}$ Ac.	39955	95 4 3	169782	247 12 9	279795	358 2 3	340120	323 6 2	167906	185 2 5	293700	255 11 6
No. of flowers and income per acre by sale of flowers.	26627	63 8 2	113188	165 3 2	186517	238 12 2	226746	215 9 5	111967	123 6 11	195800	170 7 10
Approximate amt. by sale of layers per acre.		25 0 0		25 0 0		25 0 0		25 0 0		25 0 0		25 0 0
Total income per acre		88 8 2		190 3 2		263 12 2		240 9 5		248 6 11		195 7 10
Cost of cultivation per acre*		90 0 0		50 0 0		50 0 0		50 0 0		50 0 0		50 0 0
Net gain per acre		−1 7 10		140 3 2		213 12 2		190 9 5		193 6 11		145 7 10

* Kist excluded. Maximum return is obtained in the third year of planting,

From the above table it could be seen that the prices at Madras city have been going down every year and that the price during 1937 is not even half of what it was in 1932.

Cost of cultivation of one acre of Roses.

	Rs.	a.	p
First Year :—Preparatory Cultivation :—			
4 ploughings with country ploughs @ 8 annas per plough and man .... 8 pairs of animals and 8 men.	4	0	0
Seeds and Plants :—			
Cost of 2000 well-layered plants @ Rs. 2 per 100.	40	0	0
Marking out, digging with mammatties and planting the layers at $4\frac{1}{2}$ feet apart each way and pot-watering .... 10 men @ 4 annas	2	8	0
Manures and Manuring :—			
First manuring at 2 cart-loads and second with 10 cart-loads of farm yard manure after six months, i. e., 12 c. l. at 8 annas.	6	0	0
Carting manure to the field—2 men and 2 pairs of animals.	1	0	0
Digging around plants, applying manure and covering up. 16 men @ 4 annas (6 for the first, and 10 for the second).	4	0	0
After Cultivation :—			
Seven hoeings with mammaties at 12 men per acre each time.	21	0	0
Irrigation :—			
Irrigating with tank water 40 times in the year—10 men at 4 annas.	2	8	0
Harvesting :—			
Picking of flowers (done by the owner himself).	3	0	0
Miscellaneous :—			
Kist on land.	6	0	0
	90	0	0

Second and subsequent years—Charges for each year.

	Rs.	a.	p
Seven hoeings—12 men each time.	21	0	0
Manuring twice with 10 c. l. of F. Y. M. each time at 8 annas per c. l.	10	0	0
Carting manure and distributing—2 pairs and 4 men.	1	8	0
Digging round the plants, manuring and covering—24 men.	6	0	0
Layering the plants—8 men.	2	0	0
Irrigating with tank water—10 men at 4 annas.	2	8	0
Kist on land.	6	0	0
Picking of flowers.	3	0	0
Total.	52	0	0

The writer is greatly indebted to Sri V. Satagopan, L. Ag., Secretary South Arcot Groundnut Market Committee, Cuddalore for reading through his manuscripts and making very valuable suggestions in preparing this note. He is also grateful to Messrs. N. Muthunagaraja and K. Lakshmanaraja of Iquaripalayam village for providing him with the necessary statistics with regard to the cultivation of roses.

Two Exotic Weeds—How best to use them.

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When Mr. S V. Ramamurty, I. C. S., was the Director of Agriculture, Madras, he drew the attention of the Departmental Officers to the problem of utilisation of weeds that cannot be prevented from growing. In 1938 the writer observed two such weeds viz., *Croton sparsiflorus*, Morong, and *Tridax procumbens*, Linn., which have been growing not only in Coimbatore, but all over the Presidency in so rank a fashion that it struck him that the potentialities of these two weeds must be discovered. In Coimbatore the writer has often found buffaloes grazing on *T. procumbens*, Linn. which led him to think that this weed must possess fodder value and in the case of *C. sparsiflorus*, Morong, he was very much struck with its luxuriant growth and its dark green leaves that it set him thinking that it should serve as a very good green manure. Independent of the writer, enquiries were being made by the District Agricultural Officers regarding this latter weed and its suitability as a green manure. Advantage was taken of this also and both these weeds were sent to the Government Agricultural Chemist for analysis. In this is given a brief botanical description of each of these weeds along with the chemical analysis as it was done by the Chemist.

Croton sparsiflorus Morong *Family : Euphorbiaceae*. (*Tamil :* Milagai pundu; *Telugu* : Seema mirappa.)

From the Tamil and Telugu names given to the plant, one can easily understand that the ordinary layman's eye has been caught by the close resemblance which this plant bears to the chilly—*Capsicum annuum*, Linn. There are however certain very broad characters in the vegetative parts of the croton weed which leads the lay man to mix it up with the chilly and these are the sympodial habit of its branching and the narrow lanceolate dark green leaves. It is here that one has to stop and think how important floral characters are in the determination of a species and its family. The plant is a native of Paraguay (South America) and is said to have first arrived in Bengal, in 1910. It is found today all along the East Coast from Assam down to Tinnevelly, chiefly confined to railway embankments. From the coastal areas, the plant is spreading into the central districts and at Coimbatore it is the commonest and most luxuriantly growing weed not only on road sides, but all along the tanks, streams and river bed. In South India, the plant is said to have been first collected at Tirukarrangudi (Tinnevelly District), 17 miles away from the nearest railway station.

The plant is an erect diffusely much branched annual herb growing to a height of 1 to 3 feet. The root system is shallow and surface-feeding. The main stem is green, woody at base and has sympodial growth after flowering. The plant is rough to the touch due to stellate hairs present all over it. The leaves are simple, alternate, exstipulate and crowded towards the tips of branches. The inflorescence is an erect androgynous spike

3—5" long with a few female flowers at its base and small sparsely set clusters of male flowers above. The fruit is a 3-lobed capsule dehiscing into 3 bits each enclosing a seed which is about 1/4" long, oblong, polished and mottled on the round back. There is a caruncle, a cushiony out growth on the tip of each seed as in castor.

Chemical Analysis.

Moisture.	8·42%
Loss on ignition.	80 81%
Insoluble mineral matter.	0·35%
Nitrogen (N)	2·32%
Potash (K_2O)	3·71%
Phosphoric acid (P_2O_5)	0·38%

"This contains fair amounts of potash and nitrogen and can be very well used as a manure, after composting"

Tridax procumbens, Linn. *Family* —*Compositae*. (*Tamil* : Kallipundu, Gayavettu thalai; *Telugu*: Bokuvulu aku).

The plant is a native of South America and must have been introduced long ago as it has been with us for several years now, and has found a place in the Madras Flora (2).. It is commonly met with on road sides and waste places in all dry districts and on all the low hills of South India up to an elevation of 2,000 feet or more. It is a straggler and a hispid perennial herb of 1 –2 feet or more high with a few branches spreading on all sides. Leaves simple, exstipulate, short stalked and very much cut. The flowers are yellow and borne on long terminal heads, the stalk of the head being 10 inches or more. The plants in flower look very much like small *Chrysanthemums* from a distance Florets are yellow and of two kinds, the outer ligulate and female, the corolla being 3 lobed and the inner disc florets tubular, hermaphrodite, the corolla being 5 lobed. The achenes have a feathery pappus. The plant produces seeds in abundance, as many as 500 to 1,500 per plant.

Chemical analysis.

Heads of analysis.	On dry basis.	On original moisture basis.
	%	%
Moisture ...	...	81·11
Ash ...	23 16	4·38
Crude proteins ...	9 97	1·88
Ether extractive ...	3·15	0·59
Crude fibre ...	29 83	5·64
Carbohydrates (by difference.)	26·83	6·40
	100·00	100·00
Albuminoids ...	8·13	1·54
Insoluble mineral matter	8 35	1·58
Iron (Fe_2O_3) ...	0·85	0·16
Alumina (Al_2O_3) ...	1.00	0·19
Lime (CaO) ...	4 80	0·91
Magnesia (MgO) ...	Traces	Traces
Potash (K_2O) ...	3·76	0·71
Phosphoric acid (P_2O_5)	0 68	0·13
Nitrogen (N) ...	1·60	0·30

"The sample contains fairly good amounts of food ingredients, but the fibre content is a little too high. Probably, it is this factor that makes it more favoured by buffaloes than by cows. The weed is particularly rich in lime content".

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Cardamom Cultivation in the Bodi Hills.

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During 1937 there was a severe infestation of *Taenothrips cardamomi* on most of the cardamom estates in the Bodi Hills. The planters suffered a heavy loss. Some of them appealed to the Deputy Director of Agriculture, Madura for help early in 1938. In response to their request, the author was deputed to investigate this pest. This opportunity was taken to study cardamom cultivation as practised in these areas and the study continued as and when opportunities occurred. The materials gathered are summarised below.

Cardamom—(*Elettaria Cardamomum*, Maton) is a valuable spice. The plants are found growing luxuriantly in a wild state in elevated sheltered areas, scattered in the thick humid ever green shola regions of the Western ghats, with an annual rainfall ranging from 100 to 150 inches. There are only limited areas satisfying the above conditions and these are confined to the Western ghats in parts of Mysore, Coorg, Cochin, Travancore and Madras Presidency. According to an official estimate the total area under cardamoms in South India is about 86,134 acres but there are reasons to believe that the area is at least 100,000 acres.

The description of the plant *Elettaria Cardamomum*, as given by Fischer[1] is given below,—

Flettaria Cardamomum, **Maton.** Western ghats, wild and cultivated, 2500—4500 ft. The Cardamom.

Leafy stem 6—10 ft. high; leaves linear—lanceolate acuminate, sessile or very shortly petioled, glabrous above, softly pubescent beneath, 1—2 ft. long, 2—3 in. wide; panicles several, upto about 2 ft. long, erect or prostrate; bracts 6—7 flowered, linear oblong, obtuse, about 1.5 in. long, corolla tube shortly exserted, lobes 0·5 in. long, lip longer, white striped with violet; capsule sub-trigonous, about 0·4 in. long, striate.

Var. *major*, more robust, leaves broader bracts more distant, 2—4 flowered; capsules 1" or more long. In the same localities.

The seeds of both used as condiments and medicinally.

There are 2 cultivated varieties, the Mysores and the Malabars. The chief characteristics of these varieties are given below:

	Malabar.	Mysore.
Suitable elevation:	2000 to 5000 ft.	3000 to 4000 ft.
Rainfall:	60 to 100 in.	Withstands heavier rainfall and wind
Height—leafy stems.	6 to 9 ft. light green.	More robust and taller darker green.
Tillering:	10 to 30 tillers in well grown mature clumps.	Tillers more profusely.
Leaves:	2 to 2½ in. broad. 1—1½ ft long, tips pointed upper surface smooth and the lower surface velvetty or smooth.	3 to 6 in. broad. 2 to 3 ft. long. Smooth on the upper surface and glabrous below.
Racemes:	I to 2 ft. long trailing along the ground.	2 to 3½ ft. long, erect.
Spikelets:	11 to 22 on each of the racemes.	22 to 48 on each of the racemes.
Fruits:	Light green 1/5 to 9/10 inches long, angular with 18 to 23 black seeds closely packed. Fruit coat thin.	Darker green, bigger in size globose with 22 to 32 seeds. This gives about double the yield of Malabars.
	The floral racemes and the flower bearing shoots die, soon after the season's pickings are over.	The racemes continue to live and bear fruits in the succeeding season also.

Cardamoms may be propagated either by rhizomes popularly called "bulbs" or by seeds. The common method of propagation is through 'bulbs'. Bulbs $1\frac{1}{2}$ to 2 years old with at least two tillers from individual clumps which are healthy, high yielding and regular bearing. These are forked out and separated from the mother plants, taking care to see that the rhizomes are intact and uninjured. The roots are clipped leaving a length of about 6 inches before planting. Five such bulb plants are planted in each of the pits in the field. Bulb plants begin to yield earlier. Hence it is easier to start and maintain a plantation with bulbs. But these are said to be short-lived and less vigorous and hence have to be replanted after about 15 years. Of late, owing to the difficulty in getting mosaic-free bulbs for planting, some of the more experienced growers are raising seedlings for planting. The seedlings being free from mosaic to start with, yield better and remain healthy for a longer period; hence seedling planting has come into vogue, and is extensively practiced in some of the important estates in the area.

Selection of seeds. Well ripe plump fruits from healthy robust and disease-free clumps are gathered in September and air-dried in the shade. A few days before sowing, the seeds are separated. These seeds are soaked in water over night, rubbed gently between the hands to remove the sugary coating on them; else, ants are likely to invade the nursery and remove the seeds causing gaps and uneven germination.

Nursery. During February—March seed nurseries are prepared near channels or springs to facilitate watering. Raised beds 1 yd. × 15 yds. are formed from the top soil, which is usually very rich in humus. Stems, broken twigs and other hard materials found there are removed. These beds are watered once a fortnight. Weeds are removed as soon as observed so that they are eliminated to a great extent before sowing. On such carefully prepared beds, good seeds are sown in August. About half a pound of seeds is sown in three beds, to get enough seedlings to plant one acre. After sowing, fine sand is sprinkled over and the beds gently stirred or worked with hands to cover the seeds. A layer of straw or dry grass is spread over these beds to prevent erosion of the soil particles and to hasten germination. These beds are gently watered twice a day with rose-cans, till the seeds begin to germinate i. e., 30 to 40 days, care being taken to see that the surface soil is moistened and wetted and no water stagnates on the surface even for a short time. Nurseries are usually located in open areas near dwelling quarters for proper supervision and maintenance of the tender seedlings. The beds are protected from the direct sun by wicker *pandals* erected over them. Growers believe that the morning sun is injurious and the mild evening sun beneficial to the growth of the seedlings. As such the beds are usually given a western aspect. When the seeds have germinated and the seedlings are two inches or so high, the covering over the pandals is reduced, so that the seedlings receive just a little of the sun. As the seedlings grow older, the top of the pandal is gradually cleared so as to allow more sun on them and thus become hardened under natural field conditions.

First transplanting Seeds sown in August germinate by the middle of October. By the following May i. e., 8 to 9 months after sowing, the seedlings grow about one foot. These tender seedlings are then carefully forked out and transplanted in singles 6 to 8" apart in fine nursery beds, prepared in shady parts. The transplanting is finished by the end of June before the Monsoon sets in. If planted during the rains, the rhizomes may rot and the seedlings die out. Hence the transplanting is done before the rains.

Second transplanting. By the following April—May i. e., 1 year and 9 months after sowing, when the seedlings have grown to a height of 2 to $2\frac{1}{2}$ feet with 2 or 3 tillers, they are replanted in the field 3 feet apart.

Third transplanting. During the next pre-Monsoon season, they are again replanted in the field 5 to 6 feet apart (2 year 9 months). By the following May—June, these transplants being 3 year and 9 months old, some of the vigorous ones begin to flower. Now these are ready for final planting.

Fourth and final planting. These seedlings are planted in the field finally during the succeeding April—May in pits that are previously prepared and kept ready for planting. At the time of each planting, the seed

lings are carefully examined and the diseased ones discarded choosing only the healthy plants for replanting. As the age of the seedlings advances, the height of the plant and the number of tillers increase and hence the distance between plants is increased at every successive replanting to allow room for the tillers that grow. These seedling plants are planted in singles with all the tillers intact. In some of the estates, the seedlings are planted 10 feet apart in the field at the time of second planting when they are $1\frac{1}{2}$ to 2 years old to save another transplanting charges the expenditure in maintaining a larger area properly is heavier.

Transplanting in the field. The area to be planted is carefully surveyed and roads traced according to the contour of the land.

Planting distance. The distance between plants varies according to the natural fertility of the soil and the variety. In richer soils the average spread of each Mysore-clump is about 6 feet. On such rich soils, they may be planted 12 feet apart. In poorer soils they may be planted closer. Similarly the Malabars may be planted 10 feet apart in richer soils and closer in poorer soils. But usually in most of the plantations they are planted 11 feet apart which is the average distance irrespective of the variety and soil.

Lining. Lines are marked along convenient angles 11 feet apart, both lengthwise and cross-wise, and stakes driven at the intersection of these lines. On the marked spots, pits are dug 2 feet square and 1 foot deep on the lower slope. The bottom of the pits should be level and even. The depth on the lower slope alone is to be considered when measuring the depth of individual pits. The dug out soil is heaped over on one side of the pit, so that when the pits are to be filled up before planting, only good rich surface soil around the pits may be used. The pits are dug out in February – March, allowed to weather for about two months and then filled up with surface soil. About 360 pits are dug to an acre.

Filling pits. The rich surface soil on the top and two adjacent sides to a depth of about six inches together with the accumulated leaf mold is gathered and the pits filled up. When the pits are filled up, the rich soil is heaped on the top, to allow for sinking later on. Then the surface is made even by spreading the dug out soil from deeper layers. After a month these pits are reopened, undecomposed twigs, small stones etc., are removed, the whole soil is thoroughly mixed, and refilled. A stake is fixed in the centre of the top margin of these pits to indicate where the seedlings are to be planted. By the middle of May, these operations are finished and the pits kept ready for planting. The seedlings are finally transplanted during April—May.

Planting. The seedlings are forked up carefully, the individual clumps separated and the roots pruned to 3 or 4 inches, care being taken not to injure the rhizomes. Healthy plants are gathered and taken to the area where they are required for planting. The seedlings are placed on the

right of the indvidual pits, the bulbs on the lower side and the shoots above, with the upper surface of the leaves facing the Sun.

A central line is drawn along the middle of the pits from side to side a small trench 6 inches deep is made above this line, and the earth collected on the right margin. Either seedlings or bulbs, whichever is selected are planted in these pits, the tallest tiller is arranged in the centre with the small ones on the sides so as to form a sort of symmetry. These are made to lean on the soil. If planted erect, they are likely to be uprooted by the strong Monsoon winds that follow closely the planting season. The soil around is pressed down and leaves and leaf moulds are spread over the pits so as to form a thick mulch.

Shade regulation. Planting over, the area is surveyed with a view to regulate shade. The Mysores are hardier and can withstand a little more sunning than the Malabars. The Mysores require about four hours of sun and the Malabars about three hours of sun every day. During the sunny part of the day, the more shady trees are marked and these are confirmed or modified after subsequent observations and the marked trees felled or the branches lopped off, so as to get the optimum amcunt of sun-light for the plants beneath. If too shady, the central branches are removed to have open crowns and the lateral branches induced to grow better.

While thinning, the following species of trees and shrubs are eliminated as they are unsuited either being thorny, or in some cases the Cardamoms are observed not to thrive well under the shades of these trees:— Eriodendron sp. Grewia tiliaefolia. Symphorema involucratum, Salix tetrasperma, Kydia calycina, Macaranga Roxburghii, Acacia lucophloea, Wrightia tinctoria, Semicarpus, sp. Solanum pubescens.

As far as possible the following trees are not to be removed while thinning, even though some of these may be mere saplings.

Chuckrasia sp. Vateria indica, Jak, Acrocarpus fraxinifolius, Cullenia excelsa, Pithecolobium subcoriaceum, Mango, Mesua ferrea, Nephelium longana.

If more shade is required, some of the quick growing trees such as *Acrocarpus fraxinifolius, Nephelium longana* and *Mesua ferrea* may be planted. The thinning out of the existing plants and the planting of fresh ones is adjusted to suit the variety planted. The leaves from the felled trees are carefully conserved for forming mulch over the newly planted area.

Time of felling trees. For shade regulation, trees and branches in the denser parts are removed in April. By May—June, plantings may be over and shade regulation work commenced immediately and finished by September. If the shade is not regulated within two years after planting, the plants will not yield properly at the end of the third year.

After-cultivation. The newly planted field is weeded as often as is necessary to keep the pits free from weeds. During the first two weedings, the weak and dead plants are replaced. About four weedings are necessary during the first year, three in the second year and two in the succeeding years between July and November. During weeding, the dead leaves and shoots are cut and scattered around the plants to provide mulch. The dead leaf sheaths, shoots and flower stalks are not to be pruned too close to the root, as the rhizomes are likely to dry up if done so.

Flowering, fruiting and picking. By the following pre-Monsoon season i. e., 5th year from sowing—the plants will begin to flower here and there. More plants will flower in the sixth year i. e, two years after final planting and regular yields may be expected from the third year onwards. Simultaneous with the development of a flowering raceme, at the base of each mother shoot, two more ordinary leafy shoots develop. When the mother shoots die out after the season's picking, these secondary shoots take their place and when two years old, in their turn develop the flowering racemes. Increased yields are obtained as the plantation gets older, as more tillers and racemes are formed with the age of the plants. But the clumps get displaced, every year and the regular lines on which they were originally planted get obliterated So, in general the planting is renewed every 15 years or so according to the condition of the plantation and the displacement of the shoots from the original place of planting.

In a plantation flowers and fruits may be observed almost throughout the year. But the optimum flowering period is during the dry pre-Monsoon period i. e., May to July. It takes about four to four and a half months for the flowers to develop into fruits ready for picking and consequently the peak of harvesting is from September to November.

Well ripe fruits are light green and the seeds inside are hard, greyish black and very fragrant In a spikelet, fruits of different maturity may be observed to develop at a time. Only ripe fruits must be picked. While curing, the unripe fruits shrink considerably as the seeds inside are juicy and not hard. If fruits are not picked in time, these are shed and lost or greedily devoured by animals. The over ripe fruits get split while curing and the seeds which are shed from the capsules are not much valued in the market. Hence the fruits must be picked at the right time. During the heavy picking season, coolies are sent round the estate once in about ten days and the ripe fruits are collected.

Curing and grading. The fruits when picked are juicy. These are cured—dried—before they are ready for the market. Formerly they were cured by a tedious process of bleaching with sulphur, washing and drying until the required colour is obtained and the fruits dried sufficiently. This is now replaced by flue-curing which process is easier and can be wellcontrolled irrespective of the prevailing weather conditions.

The cured fruits are cleaned. Flower stalks, immature and split fruits are separated along with those that are diseased or scabby. These are sold as "thakkolam." The seeds are collected and removed. Good entire fruits are graded and marketed separately.

Yield. The plants usually begin to yield from the third year of planting. During the third year 10 lbs. of cured fruits may be expected per acre. The yield increases year by year and from the fifth year onwards 120 to 200 lbs. of cured fruits may be obtained from an acre, according to the condition in which the plants are maintained, for about fifteen years. Then the yield decreases gradually. In well-maintained estates, in good localities and in favourable years, yields higher than 200 pounds are obtained. There are some plantations which are more than 25 years old giving an average yield of 200 lbs. per acre. But these are exceptional.

Pests and diseases. Some of the important pests and diseases of cardamoms are noted below :—

Nursery :	Cut worms Root grubs Grass-hoppers	destroy seedlings and young plants.
Plantation :	Eupteroid.	Caterpillars descending in numbers by silken-threads from shade trees and attacking cardamom plants and destroying them completely in certain years.
	Dicocrocis.	Stem borer.
	Tineid.	Root borer.
	Taenothrips cardamomi :-	Sucking flowers and causing warts on fruits
	Rats, squirrels, frogs, elephants, wild boars, porcupines, and monkeys.	
Disease.	Mosaic or Marble disease.	

Of the above mentioned pests and diseases, thrips and mosaic are most dreaded and are present in most of the estates. Consequently the average yield in some of the estates has decreased considerably and in some of the estates the ill-effects of these are so bad, that they have been neglected in despair by the owners.

Trials were conducted in two estates :— (1) Sathurangapara estate and (2) Gandhipara estate to control thrips (*Taenothrips cardamomi*) during 1938 season, in consultation with the Government Entomologist, Coimbatore. The following observations were made regarding this pest :—

The extent of loss due to thrips havoc is estimated to be about fifty per cent. These insects live mostly inside the flower bracts and leaf sheaths. In badly infested spikes, the blossoms wither and are shed before the seeds set, and the fruits if developed are malformed and warts are developed.

Opportunity was taken to see whether this pest could be controlled by the use of the following methods :—

Dusting (1) Tobacco powder mixed with 4 times the quantity of road dust,

(2) Lime sulphur—4 of lime and 1 of sulphur.

Spraying (1) Tobacco decoction

(2) Phenyle—diluted to about 50 times with water.

The dustings were not satisfactory whereas the sprayings with tobacco decoction and phenyle proved to be effective and a large number of thrips were killed. The sprayings could not be carried on regularly, owing to the receipt of frequent rains but they were not sufficient to wash down the insects. In the case of sprayed plants, the shedding of buds and blossoms were greatly minimised and the fruits well developed without warts or malformations, whereas the reverse was the case among the untreated plants.

Economics. The cost of starting and maintaining an area of 50 acres till it begins to yield normally for seven years is given in the appendix.

A capital investment of about Rs. 25,000 is required to start and maintain a cardamom estate of 50 acres in a virgin area upto its seventh year when the yield becomes regular. From the seventh to the fifteenth year for about nine years, a high average is maintained, and from the sixteenth year onwards the yield gradually decreases until about the twentieth year or so when the plantation has to be renewed. From the third to the seventh year of planting, it yields about 33,500 lbs. of capsules valued at Rs. 41,875. Deducting the amount invested there is a net balance of Rs. 16,759 for the seven years. From the 7th to the 15th year there is a net gain of Rs. 10,000 per year or Rs. 200 per acre.

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Appendix.

Economics of starting and maintaining a Cardamom Plantation of 50 acres upto its 7th year.

Particulars.	Units of labour.	Rate. Rs. a. p.	Total expenditure. Rs. a.	Yield in lbs.	Value Rs.
I Year.					
Clearing ...	2250	0 5 4	675 0		
Lining ...	400	0 4 0	100 0		
Marking pits and gathering leaves	400	0 4 0	100 0		
Digging pits (360 per acre) ...	725	0 6 0	261 14		
Shade regulation ...	150	0 6 0	56 4		
Filling pits ...	400	0 4 0	100 0		
Removal of twigs, stones, etc., from filled up pits and refilling ...	200	0 4 0	50 0		
Planting, carrying seedlings, etc. ...	550		200 0		
Trashing ...	200	0 4 0	50 0		
Felling trees, etc. ...	150	0 6 0	56 4		
Weeding 4 times ...	1600	0 4 0	400 0		
Cost of seedlings at Rs. 35 per 1000 at 5% for filling up gaps ... (21000) seedlings ...			705 0		
(If bulbs 100,000 @ Rs. 10 per 1000).					
II Year.					
Weeding 3 times ...	1200	0 4 0	300 0		
III Year.					
Weeding 2 times ...	800	0 4 0	200 0		
Pruning ...	200	0 4 0	50 0		
Picking @ 10 lbs. per acre at Rs 2 per 20 lbs. valued @ Rs. 1/4. ...	200	0 4 0	50 0	500	625
IV Year.					
Weeding 2 times ...	400	0 4 0	100 0		
Pruning ...	200	0 4 0	50 0		
Picking, curing, etc. @ Re. 1 per 10 lbs. yield 60 lbs. per acre. ...				3000	3750
V Year.					
Weeding 2 times ...	300	0 4 0	75 0		
Pruning ...	400	0 4 0	100 0		
Picking, curing, etc @ Re 1 per 10 lbs. Yield 200 lbs. per acre ...			1000 0	10000	12500
VI Year.					
Weeding etc. as in the 5th year	700	0 4 0	175 0		
			1000 0	10000	12500
VII Year.					
Weeding etc., as in the 5th year	700	0 4 0	175 0		
			1000 0	10000	12500

Particulars.	Units of labour.	Rate. Rs. a. p.	Total expenditure. Rs. a.	Yield in lbs.	Value Rs.
Supervision charges for 7 years.					
1 Manager on Rs. 50 p. m.	...	50 0 0			
2 Fieldmen on Rs. 25 „	...	50 0 0			
4 Maistries on Rs. 15 „	...	60 0 0			
Total per month Rs. 160					
For 7 years 160 × 84	...		13440 0		
Tools and sundries	...		1000 0		
Land tax @ Rs. 5 per acre per year			1750 0		
			23519 6 or		
			23600 0		
Interest on capital at 6%	...		1516 0		
			25116 0 or		41875
			500 0 per acre.		837
Net profit for 7 years for 50 acres. (Rs. 41875 less 25116)					16759 or 337 per acre.

Note. The cost of building quarters for the Manager, and his assistants and the erection of cooly lines have not been included.

SELECTED ARTICLE

Roots

By H. C. Sampson, C. I. E.

The study of the root systems of crops grown in the tropics and sup-tropics is a branch of agricultural research which has not received the attention which it deserves, in fact, so little information has been published on the subject that one is forced to fall back on inferences rather than to depend on concrete knowledge. This study is more important in the tropics than in temperate regions, because the range of environment is so much greater, and there is no doubt that environment has a considerable influence on the root development and root system of any particular species, or of any cultivated race of a species. For example, the work which has been done at East Malling in examining the root systems of different races of fruit stocks has shown clearly that these vary both with the stock and with the type of soil on which they are grown.

A striking example of the influence of environment on the root system of a species is the case of the Neem tree *(Azadirachta indica)*, which has been introduced into the Gold Coast within the last twenty years. Its native habitat is in India, where it is generally found growing in open country in the drier parts of the country. It is not exacting in the type of soil on which it grows except that it is not seen on deep black cotton soils. Under Indian conditions the tree makes a strong tap root which penetrates vertically into the ground for a considerable depth, and it shows little tendency to form strong branch roots near the surface. In the Gold Coast the tree is now a common feature in roadside, town and village planting, and it is not unusual to see trees where the root system has been exposed by erosion. The most striking feature shown is the tangled mass of stick surface branch roots extending laterally quite close to what must have at one time been the surface of the ground. In fact, one may say that all the common exotic species of trees which are grown in West Africa develop under that environment a shallow root system. This adaptation of the root system to suit a particular environment may explain why it is that trees found useful in

one country as shade for a particular plantation crop may prove quite unsuitable or even harmful in another environment. In some of the West Indian Islands one cannot help admiring the magnificent specimens of rain tree (*Pithecolobium Saman*) which are seen as avenue and savannah trees. In popular accounts of this tree one reads how it closes its leaves when it rains and thus allows the rain to fall on the ground beneath its shade. Certainly in this environment it does not seem to do harm to surrounding vegetation. The same species grown in the drier parts of Peninsular India is, however, a menace to arable agriculture, as there it develops a wide-spreading surface root system which robs the soil of moisture sometimes for a distance of sixty to seventy yards. This makes it impossible to grow rain-fed crops on the area of its root spread, and it is a common complaint of villagers that the tree when planted as a road avenue renders the adjacent land useless for agriculture.

Apparently little has been done to study the root systems of plantation crops in the tropics. If it has, very little literature is available on the subject, and such information as exists deals only with particular environments. The matter is of great importance, especially in the case of plantation crops which are interplanted with shade trees and cover crops; for it seems essential to appreciate what amount of root competition exists between the shade tree and the crop. Of course in some soils this is more important than in others. In heavy soils retentive of moisture and where the rainfall is heavy, such competition may be of actual value, because the roots of the shade tree may assist in draining the soil, thus providing a suitable environment for the roots of the crop. This may explain why it is that shade trees in cacao are advocated in Trinidad whereas in the nearby island of Grenada it is grown without shade.

Information regarding the root systems of plantation crops is often required when laying out experimental plots. A knowledge of the root-spread of individual trees, for example, is essential when laying manurial experiments, in order to decide how many guard rows are necessary between plots. It was a matter of surprise to be told the other day that when the root system of a mature oil palm was exposed, several of the roots extended over 100 feet, while the longest measured 127 feet. This was in a sandy soil with a fairly high water-table, and of course may not represent the root spread of a palm grown on a heavier, deeper and more fertile soil.

Various theories have been expressed on the action of the bush fallow, which is common throughout tropical Africa, where shifting cultivation is the rule, in restoring fertility to the land. The one which seems most important is the deeper root system of the natural tree vegetation which brings up from deeper levels to the surface soil additional amounts of plant food. A striking example of an artificial bush fallow is found in the densely populated region of the Eastern Province of Nigeria. Among the Ibo people, who inhabit the deep sandy soil country of the palm belt, each household has its compound land, but there is also an expanse of communal land. Among many of the clans, however, it is the custom that if one of its members plants up a portion of the common land with a small rosaceous tree called *Acioa Barteri*, he is allowed to crop that area for his own use. An opportunity was given to see the root system of this tree in an area where gully erosion was severe. The gully had been checked by a planted patch of this tree, and the roots of one or two were exposed at the edge of the gully. The tap root went vertically down for a great distance, and there is little doubt it is this deep root system that has established the reputation of this tree for restoring fertility to the surface soil.

In the case of arable tropical and sub-tropical crops little information is available. Weaver has described the root systems of several sub-tropical crops

which are grown in the United States, but it is felt that much more local research is necessary to gain knowledge regarding particular environments and particular races of cultivated crops.

The monocotyledons include all the cereal crops as well as such crops as onions, ginger, etc. The peculiarity of all such crops is that they do not form a tap root. Their roots are more or less ephemeral and if damaged they die, but can be rapidly replaced by freshly formed roots. All cereal crops are for this reason capable of being transplanted, and in some cases this is the normal agricultural practice, the seedlings being raised in a seed-bed and subsequently pulled out and transplanted. Swamp rice is generally grown in this way, at any rate in the more developed rice-growing areas. The seedlings are pulled out when they have reached a certain age and most of the roots formed in the seed-bed are broken. They are further damaged by beating the butts of the bundles of seedlings against a stake stuck in the ground. In some places the seedlings which are tied in bundles, are stacked in small heaps in the field with all the roots facing outwards, and they are left in this way for two or three days for the roots to wither. Thus the transplanted crop has to start and make an entirely new root system.

The sorghum crop in India is considered to be the most drought-resistant of all cereals, and one presumes therefore that it has a deeper root system than other grain crops. There is however, a considerable difference in this repect between varieties. One variety known to the writer, it is claimed, can mature its crop provided there is sufficient moisture in the ground for the crop to germinate and form a *braird*. For the rest of its moisture requirements it is dependent on dew and on moisture in the deeper soil. The question of drought resistance in West Africa is not so clear, because, though there are numerous varieties they all appear to be long duration ones occupying the ground for six to seven months, while in India the time of maturity is considerably less than this, and there are also short duration varieties to suit districts having a short rainy season. The root systems, however, of the Indian and the West African varieties appear to be different, though this may be due to environment, since the rains are generally heavier in West Africa and the soils as a rule have a lower pH value. Local agricultural practice in the black cotton soils of India spaces the plants about 6 inches apart in rows about 14 inches apart. In West Africa the crop is grown on ridges 3 to 3½ feet wide, and the plants are spaced about 1½ feet apart in the row. Thus in West Africa each plant has nearly ten times the surface area that the plants have in India. This certainly seems to point to a difference in the root systems of the cultivated races of sorghums in these two regions.

In the drier parts of West Africa, where the rainfall is less and the rainy season shorter, the grain Pennisetums form the most important cereal crop whereas in India these are not considered to be as drought-resistant as sorghum. This again may point to a difference in the root system, though it must be remembered that many of the early sown West African Pennisetums are comparatively short-duration crops.

In the case of sugarcane, both Venkataraman and the workers at the East Indian Sugar-cane Station at Barbados have shown that there exist marked differences in the root system of different seedling varieties of sugar-cane, and it is on such differences that new varieties are selected for trials in other environments. These differences in seedling cane varieties are, however, on rather a different footing from races of cereals owing to the complex hybrid origin of the present-day seedling canes.

Apart from cultivated grass crops, recent work in Uganda has shown the value of a grass fallow where elephant grass (*Pennisetum purpureum*) is deliberately planted prior to allowing the land to go out of cultivation. It is claimed that this not only restores the texture of the soil but also its fertility, and one wonders how deep the roots of this grass penetrate to bring up from below fresh supplies of plant food. In Northern Nigeria experiments of a similar nature are being made with *Andropogon gayanus*, which judging by the way the grass can remain green in the dry season, has, one suspects, a deep root system, thus enabling it to restore fertility to the surface soil.

The principal dicotyledonous crops of the tropics belong to the family of the Leguminosae. The value of such crops in mixed croping and in rotations has often been stressed on account of their being able to fix atmospheric nitrogen with the aid of symbiotic bacteria living in their roots. With few exceptions tropical pulse crops are grown as mixed crops. Recent work in this country has shown, in the case of pastures, that the grasses among which legumes are grown can make use of the nitrogen from the roots of the legumes, and it is probable that tropical cereals, among which pulses are grown can do likewise. It is not clear whether, in the tropics, the nitrogen fixed by a leguminous crop in one season will remain available in the soil for the benefit of cereal and other crops of the next season. Experiments conducted by the Nigerian Department of Agriculture where *Mucuna aterrima* has been grown as a green manure show that there is no appreciable difference in the yield of the succeeding maize crop on plots where Mucuna crop has been ploughed in and on plots where this has been burnt on the ground. One imagines therefore, that value of the green manure crop largely lies in the fact that it has brought up from below supplies of mineral plant food, which are thus available for the succeeding crop. This is partly borne out by the fact that the pH of the plots where the Mucuna was burnt is higher than that of the plots where it was turned in. The fact that Mucuna has been most successful in areas where the lateritic subsoil is fairly near the surface suggests that its root system is comparatively shallow. In Northern Nigeria experiments are being carried out in restoring fertility with pigeon pea (*Cajanus cajan*) grown as a biennial. The fact that the plant can survive through the intensely dry season suggests that it has a deep root system. Ducker, in Nyasaland, states that the roots of the pigeon pea will penetrate a lateritic pan. In the Sudan several leguminous crops have been tried as rotation crops for cotton, and *Dolichos lablab*, agriculturally has been found to be most suitable, though, owing to its harbouring pests which damage cotton, its use has had to be restricted. This suggests that its roots can tolerate, even if they cannot penetrate, the alkaline subsoil. Another leguminous plant whose roots can penetrate an alkaline pan is *Sesbania aculeata*, and possibly other species of Sesbania may behave in the same way.

The groundnut is a legume which is generally grown as a pure crop, though sometimes it is interplanted among cereals. It is extremely drought-resistant, remaining green and fresh till it commences to ripen its pods. It is a crop suited to lighter classes of land, and its drought resistant qualities have made it a valuable asset to the light red soil districts of tropical India. On such soils it is generally considered an exhaustive crop, and yields decrease rapidly after three or four years' cropping unless the land is manured. In West Africa the crop has been extensively grown for many years and recently it has been reported that the older groundnut areas are not giving the yields that they formerly did. Considering that manuring is hardly known in West Africa, it is rather surprising that the land has not shown signs of exhaustion before this, and one can only suggest that this is due to the type of subsoil commonly found and the depth to which the roots penetrate. The red soils of India generally lie

directly on the parent rock and thus have no reserves on which to draw, while in West Africa a lateritic subsoil usually occurs.

The root system of Asiatic cottons is quite different from that of the upland cotton of the New World. The former are much more slender and penetrate much more deeply into the soil, and the tap roots of seedlings which have made only one leaf have been traced to a depth of 18 inches in black cotton soils. It is possibly because of this deeper and therefore more drought resistant root system that in French West Africa Indian cottons have been introduced into the dry north as a rain-fed crop. The variety is known as Budi and is stated to be a cross between two Indian cottons—Karunganni of the Tinnevelly district and the Garo Hills cotton. But even the Upland cotton has a much deeper root system than some other crops, and in Nyasaland it is generally stated that tobacco always does well after a cotton crop, presumably because the latter has replenished the supplies of mineral plant food near the surface.

It is unfortunate that there have been several years of low prices for tropical primary products; for at such times agricultural departments are expected to produce quick results, and no one can say that the study of root systems is not a tedious and often an expensive business. It is hoped, therefore, that when and if the prices of primary products improve more attention may be given to the study of the root systems of crops in the colonies. *The Empire Cotton Growing Review*, 16: (1939) 165—170).

ABSTRACTS

Value of Refined Coconut Oil and Butter Fat. R S. Harris and L. M. Mosher *Food Research* 5: 183.

Experimental rats were maintained on a diet consisting of extracted skim-milk powder (72 percent), extracted brewer's yeast (three percent) supplemented with vitamin A, vitamin D, and iron. These diets were abnormal in only one respect, that is, they contained an abnormally large proportion of fat. The animals were observed as to the effects of these two diets on weight increase and food consumption. Groups were guillotined after 15, 30, 60 and 90 days on the diets, and body tissues were studied histologically. Results were compared with those on rats maintained on a standard stock ration which served as control. Animals on the butter fat diet consumed a slightly larger but possibly insignificant, amount of diet but increased in weight much less rapidly than the animals on the coconut oil diet. The superior weight increase of the rats on the coconut oil diet was not adipose tissue, for the body and liver tissues of the groups contained essentially the same amount of fat (alcohol - ether extract) and true lipid (petroleum ether extract of the alcohol—ether extract). The investigation is being extended to determine whether the weight increase was due to increase in muscle tissue. The animals on both the butter fat and the coconut oil diets developed a slight fatty infiltration of the body and liver cytoplasm. This was shown by the increased amounts of fat and of true lipids and by histological examination. This fatty infiltration was equally intense in the coconut oil and butter fat groups. There was no evidence of pathological tissue changes in any animal in any group. These results indicate that butter fat and coconut oil even when fed at rather high levels in a complete diet, are equally harmless to rats and presumably to man. (Author's abstract).

Rice and Beri-Beri. It is over twenty-five years since Eijkman and his co-workers clearly demonstrated the connection between the consumption of highly milled rice and beri-beri, but, according to statistics collected by the League of Nations, the habit of using highly milled rice is increasing, and in 1937 the inter-governmental committee pointed out that the economic and other factors

underlying this tendency had not been fully studied in any country. The Coonoor Laboratories of the Indian Research Fund have now undertaken a comprehensive investigation and issued a report (*Indian Medical Research Memoirs*, No. 32, 1940). Rice is the staple diet in India, and hence the nutritive value of the Indian's food depends mainly on rice. Dr. Aykroyd and his colleagues suggest that agricultural research should aim at the production of high-yielding strains of rice, and that any tendency to abandon parboiled rice in favour of raw should be checked. It is recommended that public health propaganda should include instruction about vitamin losses during the washing and cooking of rice, and that the minimum amount of water be used for cooking and the water drunk, not discarded. *Food manufacture*, 15, (1940) 170.

War time Agriculture and food control in Germany. H. L. Franklin, *Foreign Agriculture*, 4 (1940) 207.

Under the present textile goods rationing system each individual is issued a Reich clothing card allowing the purchase of rationed goods on a quota basis of 100 "points" per year, with a spacified point value for each article. For example, a man's suit is valued at 60 points, a shirt at 20 points, a pair of socks at 5 points, a hand kerchief at 2 points, a woman's woollen dress at 40 points, other dresses at 30 points, stockings for women are the only articles for which a quantitative restriction is definitely listed each woman being allowed to purchase only six pairs a year. Not covered by the point system are over-coats, bed and household linens, and certain other rationed items for which special purchasing certificates are still required. Purchasing certificates for over-coats will be issued only against the surrender of an old coat. It is difficult to determine how the present clothing rationing under the "point" system compares with normal peace time requirements, but the best estimates available are that the permitted purchases for a middle class family are scarcely more than 30 or 40 percent of the peace time level, and for a worker's family possibly 40 or 50 percent.

Hybridisation of American 26-Chromosome and Asiatic 13-Chromosome species of Gossypium. Beasley J. O. *Jou. Agr. Res.* 60: (1940) 175—181,

In reciprocal crosses of American 26—chromosome x Asiatic 13—chromosome cotton the pollen germinates and pollen tubes enter more than half the embryo sacs. Embryo and endosperm development is initiated but soon becomes aberrent. By using the American 26—chromosome type as female and a few grains of pollen from a 26—chromosome type along with an excess of Asiatic 13—chromosome pollen it is possible to produce minute hybrid seeds. Plants can be produced from the seeds by germinating them on sterile culture media. Hybrids involving six combinations of American 26—chromosome x Asiatic 13—chromosome cottons were produced. This dependable method of producing hybirds between American and Asiatic cottons will be useful in producing numerous hybrids from which polyploids can be produced—Author's Summary.

EXTRACTS

Proper Proportioning and Timing of Nitrogen Applications.

A study was designed to determine the relation between the time of applying varying amounts of nitrogen fertilizer and the resulting cane and sugar yields, in connection with controlled pot culture procedure for sugar cane.

Single-eye cuttings of the variety 31-1939 were planted on November, 1, 1938, in Mitscherlich pots filled with Makiki soil. Adequate phosphate and potash, and ample irrigation water were supplied. Nitrogen differentials consisted of three levels: (L) *low*, or an inadequate amount for good growth of cane in the

small containers which were used; (M) *medium*, or an amount which previous experience had indicated to be approximately optimum, and (H) *high*, which probably furnished a luxury supply. Each nitrogen level (total) was applied in six different ways: (1) all in one application at 1 month (2) $\frac{1}{2}$ at 1 month and $\frac{1}{2}$ at 3 months (3) $\frac{1}{2}$ at 1 month and $\frac{1}{2}$ at 5 months, (4) $\frac{1}{4}$ at 1 month and $\frac{3}{4}$ at 3 months, (5) $\frac{1}{4}$ at 1, $\frac{1}{4}$ at 3, $\frac{1}{4}$ at 5, and $\frac{1}{4}$ at 7 months; (6) $\frac{1}{4}$ at one month, $\frac{3}{4}$ at 3 months and $\frac{1}{2}$ at 7 months. The cane was harvested at 12 months.

There were significant yield and quality differences between the three levels at which the nitrogen was supplied. It is apparent that too much nitrogen can be harmful to cane yields as well as to cane quality, more especially when heavy applications are made to young cane in such a way that the soluble fertilizer salt creates a highly concentrated soil solution within the root zone of young plants.

Several significant interactions between the amounts of nitrogen and the time of its application were indicated.

With a low level of nitrogen, its efficiency was best when the total amount was split $\frac{1}{4}$ and $\frac{3}{4}$ and applied at 1 and 3 montns. In fact, when the low nitrogen level was applied in this manner, it produced more than five of the times of application that were used with the high nitrogen level.

(b) With the medium amount of nitrogen, the poorest result was secured when the total application was made at one month. The best sugar yield was made when the total amount was split into four equal amounts and applied at 2 month intervals.

(c) With the high level of nitrogen that was used, its total application either at one month, or one half each at one and at three months, definitely reduced the amount of sugar obtained, especially since it greatly depressed the cane growth. Applied in either 3 or 4 doses, the cane yields were satisfatctory but the juice quality was poorer and the recoverable sugar considerably below that secured from the medium level.

Of incidental interest are the facts that the percentages of nitrogen in the crusher juice, green leaves at harvest, reflect the amounts of nitrogen which were supplied for this cane. R. C. M. analyses, made on soil samples taken after harvest, show that but little available nitrogen remained in the soil from any of the amounts which were supplied. *Hawaiian planter's Record* 44: (1940) 15—18).

The Mycorrhizal habit in crop plants, with a reference to Cotton.

Whether by reason of the unsatisfactory treatment in botanical textbooks or the technical difficulties presented by experimental studies in the laboratory, the subject of mycorrhizal association in vascular plants has been almost ignored in the literature of soil science.

The microbiological activities in general play a critical and even decisive part in promoting soil conditions favourable or otherwise to growth of the higher plants is not in dispute. Much of the vast and impressive literature dealing with soil humus is directly or indirectly concerned with these activities. Certain of them, as, for example, those immediatley involved in the various phases of what is commonly known as the "nitrogen cycle", have been exhaustively studied and have yielded substantial advances in knowledge.

For the plant physiologist, however, there remain serious gaps in the way to a correct understanding of the relation between the biological and chemical changes occurring in humus on the one hand and the nutritive processes of the higher plants on the other. The rule played by mycotrophy as a consequence of the mycorrhizal habit is one such gap, and there are others less easy of

definition. May it be assumed, for example, that the regular and intimate association of the soil fungi with plant roots shown in mycorrhizal relationships is closely interrelated with and conditioned by other phases of biological activity in soil? If so, can variation in mycorrhizal behaviour be used as an index of soil conditions favourable or otherwise to the growth and health of the host plants? Answers to these and related questions are of concern, not only because of the biological interest of the facts and the ending of a controversy that has long disfigured their study, but also, as it seems to the writer, because the fruits of such knowledge would contribute to better understanding of the relations of plants with the soil and the crop requirements of such as are known to be mycorrhiza-formers.

Mycorrhiza occur in wild and cultivated plants; in those growing in tropical forests and within the Arctic Circle; inhabitats so different as the high Alps and the salt marsh. Affecting an immense number of species of diverse families and occurring regularly under the most varied conditions of climate and soil, the habit challenges attention as a factor of significant potential importance to practical growers. The history of the subject goes back nearly one hundred years, from the time Nageli identified certain inclusions in the root cells of *iris* (1842) as fungal growths. Frank in 1885 first gave the name "Mykorrhiza" to describe the dual structure formed by the tree root with its associated mycelium, the phenomenon was already comparitively well-known especially to foresters. Early views ranged from that of Robert Hartig, to whom the root fungi of these were mischievous parasite hindering root action and conferring no benefit of any kind upon the hosts, to those theories of beneficial symbiosis associated especially with the names of Frank and Stahl.

It is still convenient to classify mycorrhiza into two groups, the extreme types in which show marked structural differences, correlated with the distribution and character of fungus infection. The *ectotrophic* mycorrhizas of most trees and shrubs are readily recognisable as distinct from ordinary rootlets: a sheath of mycelium is formed about the tip and younger part of the emerging rootlet and the hyphae composing it extend inward, forming an intercellular net between the cortical cells known as the 'Hartig net'. In *endotropic* mycorrhizas a more or less extensive distribuion of intercellular mycelium within the root is associated with a variable but usually scanty development of hyphae on the surface. In general, endotrophic mycorrhizas resemble ordinary roots in external appearance, although slight modifications such as irregularities of diameter or differences in opacity of the tissues may betray their character to the experienced observer. Broadly considered the endotropic mycorrhizas belong to two groups: 1. *Rhizoctonia* type form intracellular coils or "pelotons" which ultimately suffer digestion. The mycelium is septate and are believed to belong to higher fungi. 2. The second group includes a number of closely allied species or strains of widely distributed soil fungi known to form endotrophic associations with many flowering plants and also with certain ferns, club-mosses, and other cryptogam. The mycelium is not septate or very sparingly so and they possess special structural features.

Modern work has not confirmed the older view that the ectotrophic and endotrophic types of structures are sharply marked off from one another. It is known that the fungi responsible for the production of typical ectotrophic mycorrhizas may cause, under certain environmental or cultural conditions, more or less extensive intracellular invasion of the tissues resulting in mycorrhizas of modified structure. The details of mycorrhizal structure are delicately adjusted and show extreme susceptibility to modification in relation with the soil environment. It may be stated with some confidence, however, that they are often directly related with qualitative differences in the organic soil constituents

and probably also with variations in the supply of available nutrients and the forms in which these occur.

Much of the modern work has been done on groups in which the mycorrhizal relations are obviously highly specialized—e.g. orchids, heath and forest trees. Some practical knowledge, for example, in the orchid growing and in relation to problems of afforestation and the acclimatization of exotic plants, has been derived but much of it is still controversial. Apart from these specialised and critically studied groups there remain an immense and constantly growing list of plants known to form endotrophic mycorrhizas of a characteristic kind, concerning the behaviour of which under experimental conditions little or nothing is known. Many of the hosts are important crop plants, and for this reason the matter is of practical as well as theoretical interest. Both groups of soil fungi mentioned above appear to be concerned, and there is some evidence that representatives of both may be present in the same plant. The mycelium of the second type of endotrophic mycorrhiza mentioned above, is widely distributed in natural and cultivated soils all over the world; it forms characteristic organs in the root tissues, thus giving rise to a definite and easily recognized type of endotrophic structure. Much of the knowledge has been summarized and critically reviewed by Butler. The mycorrhizal-formers are believed to be a group of closely allied species of soil fungi belonging to a single genus for which the generic name *Rhizactophagus* is provisionally accepted by Butler. Although not highly specialized these root fungi resist isolation and for this reason experimental evidence of their behaviour in pure culture or of the host plants under fully controlled conditions with and without infection is scanty or lacking.

Of crop plants of temperate climates known to form mycorrhizas of this kind, wheat and other cereals, hops and strawberry are typical examples. Of tropical and subtropical crops may be mentioned sugar-cane, rubber, coffee, citrus, oil palm (*Elaeis* sp.) coconut, cacao and cotton. The impression derived from the observations on cotton was as follows: The cotton plant is a regular mycorrhiza-former, infection taking place under favourable conditions at an early stage. The incidence and character of infection are closely correlated with the nature of the rooting medium and in the same soil vary markedly with different manurial treatments. Differential behaviour on the part of the endophyte was particularly well-marked in respect to applications of inorganic as compared with organic manures and a response was also apparent following the use of different forms of organic manures. Coincidence of vigorous growth of the host with maximum infection may be observed in cotton as in other plants showing the same type of association, and this together with the histological evidenee available supports the view that there is a substantial balance in favour of the vascular partner.

It is the author's deliberate opinion, that variations in mycorrhizal response can be used as an index of health and growth, and that correct interpretation of these responses is an essential move towards better control of the soil conditions promoting health, vigour and maximum resistance to disease. For species growing in nature the mycorrhizal condition in a healthy plant represents one of physiological equilibrium. Mycorrhizal association, often ignored or treated as an accidental and casual phenomenon, is a manifestation of biological soil activity, and as such cannot be profitably overlooked in the study of soil factors likely to promote healthy growth and maximum resistance to disease.

Except in certain cases, notably in those directly associated with the 'nitrogen cycle' the interrelations of biological soil activities are of great importance in attempting to relate plant growth with soil conditions. No true picture of the soil as an environment in which the root system of vascular plants passes its

life can be formed if there is omitted a biological component so frequently present and often so abundantly developed as the mycorrhizal system. For e. g. although there may be at present no information as to the interaction of this habit with the organisms and soil factors operative in root diseases, yet it would appear dangerous to assume none to exist. Nevertheless instances are not wanting in recent researches in which the normal condition of the root tissues in respect to mycorrhizal infection, even in well-known and admitted mycorrhizal-formers is completely ignored in pathological investigations. (*Empire Cotton Growing Review*, 16: (1939), 171.)

Gleanings.

Powdery Mildew of the Rose. Black Spot and powdery mildew are the two most common diseases affecting rose bushes. Each is caused by a distinct type of parasitic fungus, and growers may be interested to know that the fungicide recommended for control of black spot is also effective against powdery mildew. Plants affected with powdery mildew show characteristic light grey or whitish patches on the leaves, shoots, thorns and buds. Some varieties are highly resistant (e. g., Cecile Brunner), but in the susceptible types (of which the Dorothy Perkins is an example) the disease may be so pronounced that leaf distortion and leaf fall commonly result. When these features do not develop, the disease is generally unwelcome on account of its unsightliness. Powdery mildew is favoured by warm, muggy weather and is generally more severe in bushes grown near fences or walls where air movement within the plants is restricted. The most satisfactory measure of control is to treat the plants with finely divided dusting sulphur. Tests have shown that a mixture of 9 parts of sulphur to 1 of lead arsenate is most satisfactory, the arsenate fulfilling the dual function of preventing lumping of the sulphur and of keeping down chewing insects. The first applications should be made as soon as mildew appears, and then at fortnightly intervals during the time that weather conditions favour disease development. It is important to dust before rain and, as far as possible, applications should be made when the air is calm, either early or late in the day, as burning of the foliage may occur during hot periods. Colloidal sulphur or Bordeaux mixture sprays are satisfactory for control of both powdery mildew and black spot, and may be used where spray discolouration of the foliage is not a consideration. Dusting with sulphur, however, is a very convenient method and usually can be done in a quarter of the time taken to apply the wet treatments.

(*Agr. Gaz. N. S. Wales*, 51: (1940) 384.

Soil conservation increases income. Our studies revealed that farmers following the soil conservation programme made a greater increase in their labour incomes over the 4 year period than the non-cooperators. The net increase in labour income in favour of the soil conservation service cooperators, after deducting the agricultural conservation programme payments and a fair charge for materials furnished by the Government, was; large dairy farms, 228; small dairy farms, 107; poultry farms, 75; and general farms 11. Very little, if any, of this increase in income can be attributed to saving the soil over such a short period but must be credited primarily to the change in land use and farm management practices on these farms. (*Extension Service Review* 2: (1940) 47).

Nitrogen Fixation by Blue-Green algae in Rice Fields. The role of the blue-green algae in Nitrogen fixation has been further studied particularly in relation to rice fields. From an Indian soil three species of algae of the genus Anabaena were isolated and shown to be capable of fixing nitrogen. The experimenter concluded that algae can grow and fix nitrogen in the soil independently of bacteria or fungi, and that they are the main agents of nitrogen fixation in rice field. (*Agri. Gaz. N. S. Wales*. 51: (1940), 464).

Crop & Trade Reports.

Cotton—1940—41 Second Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1938—39 has represented 9·7 per cent of the total area under cotton in India. The area under cotton up to 25th September 1940 is estimated at 913.700 acres. When compared with the area of 776,900 acres estimated for the corresponding period of last year, it reveals an increase of 17·6 per cent. The increase in area occurs in most of the important cotton growing districts owing mainly to early receipt of sowing rains. The area in the Central districts and the South relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts. The condition of the standing crop is generally satisfactory. The average wholesale price of cotton lint per imperial maund of 82, 2/7 lb. as reported from important markets on 30th September 1940 was Rs. 15—10—0 for Cocanadas, Rs. 17—6—0 for White-Northerns, Rs. 18—2—0 for Red-Northerns, Rs. 14—4—0 for Westerns (*mungari*), Rs. 17—13—0 for Westerns (*jowari*), Rs. 29—.—0 for Coimbatore cambodia, Rs. 26—13—0 for Coimbatore Karunganni and Rs. 22—5—0 for Nadam Cotton. When compared with the prices published in the last report, i. e., those which prevailed on 2nd September 1940, the prices reveal a rise of about five per cent in the case of Cocanadas, Northerns (White and Red), Westerns (*mungari*) and Nadam, four per cent in the case of Coimbatore Cambodia and three per cent in the case of Westerns (*jowari*) and Coimbatore Karunganai. (*From the Director of Industries and Commerce*).

Groundnut—1940-3rd forecast report The average of the areas under groundnut in the Madras Province during the five years ending 1938-39 has represented 48·6 cent of the total area under groundnut in India. The area sown with groundnut up to 25th September 1940 is estimated at 3,142,900 acres. When compared with the area of 2,863,200 acres estimated for the corresponding period of the previous year, it reveals an increase of 9·8 per cent.

The estimated area is the same as that of last year Tinnevelly; a decrease in area is revealed in Guntur, Cuddapah, Nellore, South Arcot, Trichinopoly and the South (Tinnevelly excepted) and it is more than counterbalanced by an increase in area in the rest of the Province. The variations are marked in Guntur (−30,000 acres), Kurnool (+90,000 acres), Bellary (+66,000 acres), North Arcot (+55,000 acres), Salem (+27,000 acres) and Coimbatore (+80,000 acres). The summer crop throughout has been harvested. The yield was normal except in Chingleput where it was below normal owing to scarcity of water in the growing period. The yield of the early crop was below normal in Salem owing to drought, and normal in Coimbatore. The condition of the main crop is reported to be satisfactory outside Anantapur, South Arcot, Chittoor, North Arcot, Salem. Coimbatore and Tanjore where it was affected by drought to some extent. The wholesale price of groundnut (shelled) per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 4—2—0 in Vizagapatam, Rs. 4—0—0 in Vizianagram, Rs. 3—15—0 in Guntur, Rs. 3—14—0 in Cuddalore, Rs. 3—12—0 in Cuddapah and Salem, Rs. 3—10—0 in Nandyal, Rs. 3—9—0 in Hindupur, Rs. 3—8—0 in Tadpatri, Rs. 3—5—0 in Bellary, Rs. 3—4—0 in Adoni and Rs. 3—3—0 in Coimbatore. When compared with the prices published in the last report i.e. those which prevailed on 12th August 1940, these prices reveal a rise of approximately 10 per cent in Tadpatri and seven per cent in Cuddapah and a fall of approximately 13 per cent in Vizagapatam, 11 per cent in Vizianagaram, 10 per cent in Bellary and Hindupur, 7 per cent in Adoni, 6 per cent in Guntur and Nandyal, the prices remaining stationary in Cuddalore. (*From the Director of Industries and Commerce*).

Gingelly 1940-41. Second report. The average of the areas under gingelly in the Madras Province during the five years ending 1938-39 has represented 16·2 per cent of the total area under gingelly in India. The area sown with gingelly up to 25th September 1940 is estimated at 437,100 acres. When compared with the area of 525,400 acres estimated for the corresponding period of last year, it reveals a decrease of 16·8 per cent. The estimated area is the same as that of last year in Cuddapah and Coimbatore; an increase in area is revealed in Vizagapatam (+13,000 acres), East Godavari (+12,000 acres), Kurnool, Tinnevelly and Malabar but it is more than counterbalanced by a decrease in area in the rest of the Province owing to want of timely sowing rains, especially in Salem (-35,000 acres), Trichinopoly (-28,500 acres), Anantapur (-13,500 acres), Chingleput (-12,000 acres) and North Arcot (-10,000 acres). The yearly crop of gingelly has been harvested in parts. The yield was generally normal except in Vizagapatam where the crop was affected by heavy rains to some extent. The main crop of gingelly has been affected to some extent by drought in Anantapur, Nellore, Coimbatore and Tinnevelly and by heavy rains in South Kanara. The condition of the crop is fairly satisfactory in the rest of the Province. The wholesale price of gingelly per imperial maund of 82⁶⁄₇lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 7—4—0 in Tinnevelly, Rs. 6—9—0 in Trichinopoly, Rs. 6—7—0 in Cuddalore, Rs. 6—4—0 in Vizianagaram and Cocanada, Rs. 5—13—0 in Rajahmundry, Rs. 5—12—0 in Salem, Rs, 5—11—0 in Ellore, Rs. 5—6—0 in Vizagapatam and Rs. 5—5—0 in Tuticorin. When compared with the prices published in the last report i. e. those which prevailed on 5th August 1940, these prices reveal a fall of approximately 27 per cent in Tuticorin, 18 per cent in Ellore, 11 per cent in Cocanada, 10 per cent in Vizagapatam, Rajahmundry and Cuddalore, nine per cent in Trichinopoly and seven per cent in Vizianagaram, the prices remaining stationary in Salem and Tinnevelly. (*From the Director of Industries and Commerce.*)

Paddy—1940-41—First report. The average of the areas under paddy in the Madras Province during the five years ending 1938-39 has represented 13·2 per cent of the total area under paddy in India. The area sown with paddy up to the 25th September 1940 is estimated at 6,437,000 acres. When compared with the area of 5,469,000 acres estimated for the corresponding period of last year, it reveals an increase of 17·7 per cent. The estimated area is the same as that of last year in Trichinopoly; a decrease in area is revealed in Guntur (-30,000 acres) Kurnool, Tinnevelly, Malabar and the Nilgiris but it is more than counter-balanced by an increase in area in the rest of the Province owing to the advent of timely sowing rains. The increase in area is marked in Chingleput (+2250,00 acres), Tanjore (+148,000 acres), Nellore (+134,000 acres), South Arcot (+95,000 acres), Vizagapatam (+90,000 acres), North Arcot (+63,000 acres) Salem (+56,000 acres) and Kistna (+54,000 acres). The first crop of paddy is being harvested in parts of the districts of Chingleput, South Arcot, Chittoor, North Arcot, Salem, Coimbatore, Tanjore, Malabar and South Kanara. The yield is expected to be generally normal The condition of the standing crop is generally satisfactory. The wholesale price of paddy, second sort, per imperial maund of 82.2/7 lbs. as reported from important markets on 7th October 1940 was Rs. 3—5—0 in Madura, Rs. 3—4—0 in Rajahmundry and Guntur, Rs. 3—3—0 in Cocanada, Ellore and Masulipatam, Rs. 3—2—0 in Bezwada and Vellore, Rs. 3—1—0 in Trichinopoly and Virudhunagar, Rs. 3—0—0 in Vizianagaram and Tinnevelly, Rs. 2—14—0 in Chittoor, Rs. 2—12—0 in Hindupur, Rs. 2—10—0 in Kumbakonam, Rs. 2—9—0 in Negapatam, Rs. 2—8—0 in Cuddalore and Rs. 2—4—0 in Conjeevaram, When compared with the prices published in the last report, i. e. those which prevailed on 12th February 1940, the prices reveal a rise of 32 per cent in Trichinopoly and Negapatam, 31 per cent in Cocanada and Kumbakonam, 29 per cent in Madura, 27 per cent in Guntur, 25 per cent in Bezwada

and Vellore, 24 per cent in Ellore, 16 per cent in Rajahmundry, 14 per cent in Virudhunagar, ten per cent in Hindupur, nine per cent in Vizianagaram, eight per cent in Cuddalore, five per cent in Chittoor and four per cent in Tinnevelly, the price remaining stationary in Conjeevaram. (*From the Director of Industries and Commerce*).

Sugarcane—1940—Second report. The average of the areas under sugarcane in the Madras Province during the five years ending 1938-39 has represented 2·8 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to 25th September 1940 is estimated at 149,420 acres. When compared with the area of 122,740 acres estimated for the corresponding period of the previous year, it reveals an increase of 21·7 per cent. The estimated area is the same as that of last year in Kurnool; a decrease in area is revealed in Guntur, Nellore, Coimbatore, and Tinnevelly, but it is more than counterbalanced by an increase in area in the rest of the Province owing to the favourable season. The increase in area is marked in South Arcot (+6,400 acres), Salem (+4,900 acres), North Arcot (+4,200 arcres), Vizagapatam (+2,200 acres), and Kistna (+2,000 acres). The areas reported for West Godavari, Bellary, Anantapur, Cuddapah, South Arcot, North Arcot, Salem, Tanjore and Malabar are the highest on record. The condition of the crop is fairly satisfactory. The seasonal factor for the Province as a whole works out to 97 per cent of the normal as against 98 per cent for the corresponding period of last year. The total yield for the Province is accordingly estimated at 413,580 tons of jaggery as against 343,120 tons for the corresponding period of last year. The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 7th October 1940 was Rs. 5—2—0 in Mangalore, Rs. 5—0—0 in Erode, Rs. 4—11—0 in Cuddalore, Rs. 4—8—0 in Rajahmundry, Rs. 4—5—0 in Chittoor, Rs. 4—4—0 in Salem, Rs. 4—2—0 in Vizagapattam, Cocanada and Adoni, Rs. 3—14—0 in Vizianagaram and Vellore, Rs. 3—1—0 in Trichinopoly, Rs. 2—14—0 in Bellary and Rs. 2—7—0 in Coimbatore. When compared with the prices published in last report, i. e., those which prevailed on 9th September 1940, these prices reveal a rise of approximately 20 per cent in Vizagapatam and five per cent in Chittoor and a fall of approximately 37 per cent in Coimbatore, 14 per cent in Salem, 11 per cent in Cocanada, ten per cent in Vizianagaram and Mangalore, four per cent in Cuddalore and three per cent in Rajahmundry, the prices remaining stationary in Adoni, Bellary, Vellore, Erode and Trichinopoly. (*From the Director of Industries and Commerce.*)

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 11th October 1940 amounted to 451,312 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939-40. The receipts in the corresponding period of the previous year were 434,832 bales. 446,957 bales mainly of pressed cotton were received at spinning mills and 114,432 bales were exported by sea while 114,327 bales were imported by sea mainly from Karachi and Bombay. (*From the Director of Agriculture*).

College News and Notes.

Students' Corner. Educational Tour:—In accordance with the pre-arranged programme the students of the third year B. Sc. Ag. Class were on tour from 1st October till 16th, led by Mr. Unnikrishna Menon, Senior Lecturer in Agriculture and Mr. T. Natarajan, Assistant Lecturer in Agriculture. Gudiatham was the first station to be visited from where the party proceeded to Kodur Fruit Research Station. In both these places enquiries were made as to the

ryots' method of raising crops, their economics and the extent to which they were benefited by the presence of the adjoining research stations. Two days' stay at the Dry farming station, Hagari, and a hurried visit to Siruguppa, contributed in no small measure to our knowledge.

Availing the opportunity a section of the students organised a pilgrimage to the famous ruins of Hampi, the historical city of the forgotten Vijayanagar empire.

In Bangalore city we paid visits to Hebbal Agricultural School, the Imperial Dairy Institute and the tastefully laid out Lal Bag gardens and notwithstanding the threatening weather the stay in Bangalore was both pleasant and instructive. On the receipt of information that the outbreak of plague in Hosur was under control, we proceeded to Hosur Livestock Research Station. Here we made the best use of the limited time at our disposal. Physical activities were not entirely neglected during the tour. We played two games one at Bellary in hockey against the town team and another at Hosur in foot-ball against the Station XI. In both we had to satisfy ourselves with a draw as only few members of the regular College team were represented in the class. Our thanks are due to those responsible for our comfortable stay at the centres and for the lavish hospitality extended to us. Our hosts were unsparing in their efforts to render our visits as educative and enjoyable as possible.

College. His Excellency the Governor of Madras paid a passing visit to the Agricultural College on 9-10—40. The students of the second year class clad in the College uniforms presented a guard of honour in front of the Freeman building. His Excellency was shown round the College by the Principal, Rao Bahadur G. N. Rangaswami Iyyangar.

Students' Club. Under the auspices of the Students' Club, Dr. Ida Scudder, Principal of the Vellore Womens' Medical School, delivered a lecture on 'The adventure of Vellore Womens' Medical School 'on Monday the 14th October. The Principal, Rao Bahadur Rangaswami Iyyengar occupied the chair. The lecturer introduced herself as a humble servant of India and briefly enumerated the innumerable services rendered to this country by her grand-father and other philonthropic American Missionaries. The traditional hospitality and the spotless affection of the Southern Indians, she mentioned, was in a large measure responsible for her determination to spend the rest of her life in this country.

The chairman, paying glowing tributes to her love of service fervently hoped that the broad appeal for funds for raising the medical school into a College, be generously responded.

At an urgent general body meeting of the Students' Club held on 22—10—'40 the question of 'Constructing a new block of Club buildings for the students' was discussed. A resolution was adopted to the effect that the new buildings shall be handed over to the Government after completion. It is hoped that the annual Club Day celebration in January 1941 will be performed in the new structure.

Games. *Foot-ball.* The first Intercollegiate match in foot-ball was played against the Government College, Coimbatore on 20—10—'40 on our grounds and we lost the match by 2 goals to nil both of which were scored during the last five minutes of the game.

Cricket. The Agricultural College cricket team won the first round of the Intercollegiate matches by getting a walk-over the Municipal College, Salem, as the latter failed to turn up.

Visitors. Among the distinguished visitors to the College and Research Institute were H. E. the Governor of Madras, Mr. S. Basu, I. C. S. Secretary, Imperial Council of Agricultural Research, New Delhi, Dr. P. L. Patel, and Dr. J. A. Muliyil, Biological Pest Control Officer, New Delhi.

Ladies' club. The annual club day of the Agricultural College ladies club is to be held on the 23rd November. The tournaments in various indoor and outdoor games are now in progress.

Personal. Messrs. M. Kanti Raj and P. D. Karunakar who were interviewed by the Public Services Commission, New Delhi, in connection with the appointment of the Assistant Agricultural Commissioner, have returned to Coimbatore. It is understood that Dr. R. Kochukrishna Pillai of Chemistry section will be proceeding to Delhi next week for an interview.

The Agricultural College Officers' Club Day. The annual club day was celebrated on 18th and 19th instant with great *eclat*. The annual dinner was held on the 18th night and the rest of the activities connected with the club day were held on the 19th amidst a number of amusements and a variety of interesting games and other items.

The following are the results of the tournaments conducted in connection with the club day.

Items.	*Winners.*	*Runners up.*
1. Tennis (singles) (C. Ramaswami's cup)	M. Kalimuthu.	C. N. Babu.
2. Tennis (doubles) (Rao Bahadur G. N. Rangaswami Ayyangar's cup)	T. R. Narayanan & P. S. Narayanaswami.	K. Sanjeeva Shetty & R. L. N. Ayyangar.
3. Contract Bridge (open) (Padmanabha shield)	K. S. Subba Rao & K. V. Gopala Iyer.	G. K. Chidambaram & P. S. Narayanaswami.
4. Crontract Bridge (Partners by lots) K. Ramiah's Cup & Mr. Dutt's Cup.	T. S. Ramasubramanian & M. A. Sankara Ayyar.	G. K. Chidambaram & P. K. Menon.
5. Table Tennis Doubles (singles) (M. C. Cherian's Cup)	N. Muthuswami Naidu	C. N. Babu.
6. Table Tennis Doubles	C. H. Krishnan & C. K. Seshadri.	E. S. Kodandaraman & N. K. Sundaresan.
7. Tenekoit (Dr. K. Narayanan's Cup)	K. Ramaswami & K. S. Subba Rao.	Dr. K. Narayanan & C. N. Babu.
8. Carrom (singles) (K. Krishnamurthi Rao's Cup)	C. H. Krishnan.	K. Santhanam.
9. Carrom (doubles) (H. Shiva Rao's Cup)	K. Santhanam & P. K. Menon.	E. S. Kodandaraman & T. V. Reddy.
10. Chess (M. U. Vellodi's cup)	E. J. Verghese.	N. Krishna Menon.

Weather Review—SEPTEMBER 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	3·7	−3·8	67·6
	Calingapatam	5·5	−1·9	42·4
	Vizagapatam	4·4	−2·1	26·0
	Anakapalli *	6·7	−1·1	34·5
	Samalkota*			
	Maruteru *	6·5	−0·9	32·4
	Cocanada	5·4	−0·4	33·7
	Masulipatam	4·3	−1·9	23·4
	Guntur*	0·0	0·0	0·0
Ceded Dists.	Kurnool	6·9	+0·7	25·1
	Nandyal*	0·0	0·0	0·0
	Hagari *	2·4	−2·4	16·0
	Siruguppa*	3·0	−3·4	17·1
	Bellary	3·2	−1·9	16·9
	Anantapur	3·9	−3·4	10·9
	Rentachintala	4·7		20·5
	Cuddapah	6·4	+0·4	27·5
	Anantharaju-pet *	2·6	−2·0	19·8
Carnatic	Nellore	3·6	−1·2	18·4
	Madras	2·8	−2·2	18·0
	Palur *	5·8	+1·9	16·8
	Tindivanam *	5·2	+1·2	19·0
	Cuddalore	6·5	+0·4	17·8
Central	Vellore	6·4	−0·9	20·0
	Salem	12·2	+5·6	34·3
	Coimbatore	4·1	+2·6	19·6
	Coimbatore A. C. & R. I.*	2·2	+0·4	15·2
	Trichinopoly	7·3	+2·5	17·2

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	1·0	−2·8	7·2
	Aduthurai *	4·6	+1·6	16·9
	Madura	4·8	−0·3	24·7
	Pamban	0·4	−0·8	11·9
	Koilpatti*			
	Palamkottah	3·1	+1·9	10·3
West Coast	Trivandrum	1·1	0·0	46·9
	Cochin	2·2	−6·8	102·3
	Calicut	8·4	+0·7	108·5
	Pattambi *	0·6	−7·4	82·32
	Taliparamba *	1·81	−8·9	132·70
	Kasargode *	3·63	−5·6	134·1
	Nileshwar*	2·4	−6·7	142·1
	Mangalore	3·1	−7·3	130·5
Mysore and Coorg	Chitaldrug	4·4	−0·1	20·9
	Bangalore	4·8	−2·2	23·6
	Mysore	13·0	+8·8	31·7
	Mercara	1·5	−9·3	128·0
Hills	Kodaikanal	7·6	+0·3	39·5
	Coonoor			
	Ootacamund *	3·7	−1·4	34·6
	Nanjanad *	2·0	−2·9	34·0

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The weather over the peninsula was characterised by scattered thunder storms during the first half of the month. On the 14th weather became unsettled in the Bay of Bengal and by the next day a depression had formed centred at about 300 miles east of Vizagapatam, and moved inland between Cocanada and Vizagapatam by the 17th, and moving in a north west direction near Portblair on the 18th and by the 19th near Surat and thereafter receding to the North East disappeared over the United Provinces by the 23rd. A second depression moved into the Bay of Bengal from the East on the 20th and was centred in the North of the Bay on the 21st but filled up the next day.

The first depression caused widespread rain on the Circars coast, Hyderabad and the Ceded districts during its traverse, while the second failed to affect the weather in the peninsula.

Rainfall was generally below normal in the Circars, Ceded districts, West Coast, Mysore and the hills, and locally in excess in the Carnatic and Central districts.

Other climatic elements were not far from normal.

The chief falls of rain reported were:—

Mysore	5·1″ (11th).
Cocanada	3·8″ (17th).
Anantapur	2·9″ (9th).
Cuddapah	2·8″ (13th).
Salem	2·7″ (7th).
Coimbatore Town	2·7″ (28th).

Weather Report for the Agricultural College and Research Institute Observatory

Report No. 9/1940.

Absolute maximum in shade.	...	93·8°F
Absolute minimum in shade.	...	66·0°F
Mean maximum in shade.	...	90·3°F
Departure from normal.	...	+0·8°F
Mean minimum in shade.	...	70·9°F
Departure from normal.	...	+0·4°F
Total rainfall for the month.	...	2·21 inches.
Departure from normal.	...	+0·42 ,,
Heaviest fall in 24 hours.	...	1·11 ,,
Total number of rainy days.	...	4
Mean daily wind velocity.	...	2·0 M. P. H.
Departure from normal.	...	−3·2 ,,
Mean humidity at 8 hours.	...	76·3 %
Departure from normal.	...	+2·8

Summary. There were numerous thunder storms during the month, 2·21″ of rain was recorded. The sky was moderately to heavily clouded and the relative humidity was slightly more than the normal. The maximum and minimum temperatures were nearly normal. The wind velocity was below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Appointments.

Sri. K. Venkatarama Ayyar, Superintendent, Agricultural Research station Anakapalle, in Category 8, class I, Madras Agricultural service to category 6, class I, Madras Agricultural service, with effect from 1st September 1940, without prejudice to his present appointment vice Sri. Rao Sahib G. Jogi Raju retired.

Sri. K. C. Naik, temporary superintendent, Fruit Research station, Kodur, to be a full member of the Madras Agricultural service in category 8, class I of the Madras Agricultural service with effect from 1st September 1940, without prejudice to his present appointment vice Sri. K. Venkatarama Ayyar.

Confirmation.

Dr. S. Ramanujam, B. A, (Hons), Ph. D (London), Second Economic Botanist, Imperial Agricultural Research Institute, New Delhi, is confirmed in his appointment with effect from the forenoon of the 1st September 1940.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. S. Suryanarayana,	A. D., Vuyyuru Sugar Factory,	A. D., Sugarcane Growers Society, Kirlampudi.
„ R. Guruswami Naidu,	A. D., Kaikalur,	A. D., Gudivada.
„ L. Narasimhacharya,	Offg. A. D. A., Bellary,	A. D., Chittoor.
„ S. V. Kuppuswami,	D. F. S., Hagari,	A. R. S., Siruguppa.
„ R. Krishnamurthi,	A. D., Saidapet,	A. D., Chengam.
„ K. B. Vaideeswaran,	A, D. Chengam,	A. D., Gudiyatham.
„ F. L. Daniel,	Offg. Asst. in Chemistry, Coimbatore,	D. F. S. Hagari.

Leave.

Name of Officers.	Period of leave.
Sri. Parameswarajotilakshminata, Asst. A. D., Bhimilipatam,	Extension of l. a. p. for 3 months with m. c. from 1—9—40.
„ V. S. Rangachary, F.M., A.R.S., Kodur,	L. a. p. on m. c. for 40 days from 7—10—40
„ N. Ranganathachari, A. D., Done,	L. a. p. on m. c. for 1 month from the date of relief,
„ S. D. S. Albuquerque, A. R. S., Pilicode,	L. a. p. for 33 days from 21--10—40.
„ D. Marudarajan, Asst., Govt. Eycologist,	L. a. p. for 2 months from 24—10—40.
Janab A. Muhamed Ali Sahib, A. D., Puttur,	L. a. p. for 1 month from 14—10—40.
Sri. B. P. Papaiah, A. A. D., Narasapur,	L. a. p. for 1 month from 6—10—40
„ C. Krishnamurthi, A. D., Kovur,	L. a. p. for 30 days from 2—10—40
„ B. N. Padmanabha Ayyar, A. D., Gingee,	L. a. p. for 1 month from 1—10—40.
„ K. Sitarama Ayyar, Farm Manager, A. R. S., Pattukottai,	L. a. p. for 1 month from the date of relief
„ M. Narasimham, A. D., Guntur,	Extension of l. a. p. for 1 month from 1—10—40.
„ S. V. Doraiswami Iyer, F.M., A.R.S., Guntur,	L. a. p. for 1 month from 7—10—40.
„ A. Mariakulandai, Asst. in Chemistry, Coimbatore,	L. a. p. for 30 days from 7--10—40.
„ L. Sankarkumar Pillai, A, D., Rasipuram,	L. a. p. on m. c. for 1 month from 29-9-40.
„ A. Krishaswami Iyer, A. D., Madura,	L. a. p. for 2 months and 23 days from 1-10-40.

„ R. Alagiamanavalan, A. D., Punganur,	L. a. p. for 1 month from 25-9-40.
„ K. Raman Menon, A. D., Coonoor,	L. a. p. for 2 months and 13 days from 11-10-40.
„ M. R. Balakrishnan, Asst. in Chemistry, A. R. S., Sirugappa,	L. a. p. on m. c. for 2 months from 17-8-40.
„ V. Satagopa Ayyangar, Secy., Groundnut Market Committee, Cuddalore,	L. a. p. p. for 4 months from the date of relief.
„ K. Govindan Nambiar, F.M., A.R.S.. Nanjanad,	Extension of l. a. p. for 2 months from 5-10-40.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the quarter ending 30th September 1940.

A. Books.

1. *Indian Weather Code.* Indian Meteorological Publication. (1940). 2. *An Introduction to the Geology of Mysore.* Rama Rao, B. (1939). 3. *The Physics of the Divining Rod—Being an account of an Experimental Investigation and Mineral divining.* Maby, J. C. and Franklin T. B. (1939). 4. *Changes in Farm Power and Equipment : Field Implements—(U. S. A. Works Projects Administration—National Research Project No. A-11).* McKibbent, E. G. etc. (1939). 5. *An outline of Indian Agriculture.* Allan, R. G. (1940). 6. *Vegetable Growing in the Tropics.* Saunders. L. H. (1940) 7. *Administrative Procedure and Practice in the department of agriculture under the Perishable Agricultural Commodities Act, 1930.* Sellers, A. and Goodrich, W. W. (1939). 8. *Trends in employment in agriculture—1909-86. (U. S. A. Works Progress Administration—National Research Project Report No. A-8).* Shaw, E. E. and Hopkins, J. A. (1938). 9. *Social Problems in Agriculture: Record of the permanent Agricultural Committee of the International Labour Office.* (1938). 10. *Revolution in Land.* Abrams, C. (1939). 11. *Federal, State and Local Administrative Relationships in Agriculture (U. S. A.) in 2 Volumes.* Ball, C. R. (1938). 12. *Principles of Economics—Vol. 2 Rev. Edn.* Taussig, F. W. (1939), 13. *Methods of Research in Agricultural Economics.* Wellman, H. R. (1939). 14. *The New Systematics: Modern Problems in Systematics in relation to General Biology Papers contri buted by several Authors.* Huxley, J. Editor. (1940). 15. *The Virus : Life's Enemy.* Smith, K. M. (1940). 16. *Statistical Theory of Estimation.* Fisher, R. A. (1938). 17. *History of the Cauvery—Mettur Project.* Barber, C. G. (1940).

B. Proceedings, Conferences and Special Publications.

1. Proceedings of the 4th meeting of the Board of Agriculture in Travancore. (1939). 2. Proceedings of the Sugar Technologists' Association of India. (1939). 3. Proceedings of the International Conference of Agricultural Economists—5th Conference, 1938. (1939). 4. Proceedings of the Ohio State Horticultural Society. (1939). 5. Proceedings of the National Joint Committee on Fertilizer Application. (1939). 6. American Fertilizer Practices—Second survey (Published by the National Fertilizer Association—A report relating to the use of commercial Fertilizers, presenting information obtained by a survey among 32,000 farmers in 35 States, U. S. A.) (1939). 7. Pioneering in Western Agriculture ; A resume of the first Half-Century of Research at the Utah Agricultural

Experiment Station. (1938). 8. Digest of Annual Reports of State Boards for Vocational Education to the United States Office of Education. (1939).

C. Annual Reports of Agricultural Institutions, Stations etc.

9. Scientific Reports of the Imperial Agricultural Research Institute, New Delhi for 1938-39. 10. Agriculture and Animal Husbandry in India - 1937-38. 11. Travancore Agricultural Department Annual Report for 1938-39. 12. Farm Accounts in the Punjab - 1937-38. 13. Sind Agricultural Department Annual Report for 1937-38. 14. North West Frontier Province Annual Report for 1937-38. 15. Central Board of Irrigation in India - Annual Report, for 1938-39. 16. England Imperial Economic Committee Annual Report 1938-39. 17. England Imperial Bureau of Soil Science Annual Report 1939-40. 18. Longashton Agricultural and Horticultural Research Station Annual Report - 1939. 19. Canadian Seed Growers' Association - Annual Report for 1937-38. 20. Louisiana Agricultural Extension Work - Annual Report for 1938. 21. Massachusetts Horticultural Society Year Book - 1939. 22. New Hampshire Agricultural Experiment Station - Annual Report for 1939. 23. New Hampshire Agricultural Extension Work - Annual Report for 1938. 24. New Mexico Agricultural Station - Annual Report for 1937-38. 25. Nebraska Agricultural Experiment Station Annual Report for 1938. 26. Nebraska Potato Improvement Association Annual Report for 1938. 27. Oklahoma Agricultural Experiment Station - Biannial Report for 1936-38. 28. Oklahoma Agricultural Extension Division - Annual Report for 1938.

Obituary.

We record with regret the death of Mr. T. A. Rangaswami Ayyangar, Agricultural Demonstrator, Tindivanam on the 16th September 1940.

The late Mr. Rangaswami Ayyangar joined the department, after obtaining the certificate of Proficiency in Agriculture at the Agricultural College, Coimbatore. He was appointed as Fieldman under the Government Sugarcane Expert in August 1917 and was promoted to the Lower subordinate service in March 1918 and remained in the Sugarcane section till January 1925 when he was transferred to District work as Assistant Agricultural Demonstrator. He worked as Asst. Agricultural Demonstrator in Salem district for about 10 years aad in Tanjore district for 4 years. He had barely spent 2 months in Tindivanam to which place he was last posted before his untimely death. Mr. Rangaswami was a hardworking and experienced officer of the department. He leaves behind him his aged mother, wife and four children to whom we extend our sympathy.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVIII.] NOVEMBER 1940 [No. 11

EDITORIAL

The Indian Coffee Control Scheme. None interested in the Indian Coffee Industry would have failed to appreciate the significance of the announcement made in the Legislative Assembly (Central), on the 15th November by the Honourable Sir A. Ramaswamy Mudaliar, the Commerce Member, that the recommendations made by the Conference of Coffee Producers and Merchants held at Madras in September last, were under the active consideration of the Government of India and a Bill very much on the lines of those recommendations would be introduced in the Assembly during this session. There is no need for any speculation on the provisions of the Bill, as it will become a public document within a few days. But the circumstances that led to this emergent legislation and what it aims to achieve are alone of interest to us. India has for long established a reputation in the world's markets as a producer of one of the finest coffees of the world, but for various reasons, of which the most important is the increasing competition in foreign markets from superior as well as inferior but cheaply produced coffees, the Indian Coffee Industry has been on the decline for the past several decades. From three lakhs of acres, the area under coffee in India has steadily fallen to the present acreage of about two lakhs. Gone are the days when the coffee planter received remunerative prices for his coffee. Instead of amounts approximating Rs. 1800 per ton, he would now be thankful for much smaller mercies say, Rs. 700 per ton, which would enable him to keep himself and his estate going. Since 1936, things have been looking up for a time, but the present war, and, particularly the collapse of France and the fall of Norway, Denmark and Belgium have rendered the plight of the Indian coffee grower almost desperate. Of the normal total annual production of coffee in India—estimated at about 18,000 tons—about 10,000 tons alone are required for consumption in India. To dispose of the balance of 8,000 tons, India must, perforce, seek the remaining foreign markets which are flooded with the 2 to $2\frac{1}{2}$ million tons of bad, indifferent and good coffees produced in the rest of the world, in many cases at comparatively lower cost per ton or as in some others under tariff protection. Even under normal conditions, the fight Indian Coffee had to put up for a place in foreign markets was unequal. Under the abnormal conditions created by the present war, the

position of Indian Coffee has become worse, to a degree unprecedented in the history of the Industry. The European markets which used to absorb annually over 5,000 tons of Indian Coffee have vanished; the off-take to the United Kingdom and countries in the Near and Middle East must necessarily be erratic due to shipping difficulties. The only external markets, still open to Indian Coffee and fairly dependable, are Burma Ceylon, New Zealand and Australia which take about 500 tons. What this state of affairs has in store for the industry can readily be foreseen. In the absence of a sheme of controlled production and marketing, a collapse in prices is inevitable, and production will have to be curtailed by abandonment of estates and about half the present acreage under coffee may have to go out of cultivation. From the trend of discussions that took place in Madras, the Coffee Control Scheme now on the legislative anvil, sets out, to correct this position, so far as is humanly possible, by securing for the producer of coffee as high a return as practicable. We trust that the contemplated legislation will rescue the industry from its present unenviable plight and restore it to a position of security in which the interests of the producer would be safe-guarded to the largest measure possible.

Coorg oranges. One of the research schemes recently approved by the Imperial Council of Agricultural Research is the improvement of the cultivation and marketing of Coorg oranges. Propagated exclusively from seed, this luscious fruit is grown largely in the rain-fed hill slopes of Coorg, Madras, Mysore and Travancore, where its cultivation is spreading rapidly. Insufficient knowledge on better methods of propagation, manuring, pruning, control of pests and diseases and marketing, now bring poor returns to the producer. The seedling trees take anything from eight to twelve years to come into normal bearing and in several districts there is a definite deterioration in production after 20 to 25 years, so that replanting becomes necessary. We trust that the scheme of research will deal adequately with all the needs of the growers and eventually set this important industry on a sure footing.

Role of Bran during the Germination of Rice.

By S. V. PARTHASARATHY, B. Sc. (Ag)., M. Sc.,

Assistant, Cotton Breeding Station, Coimbatore.

Introduction. The rice grain during the resting stage shows very little of active enzymes. However, during the germination of seeds, the increase in enzymes is rapid. The seat of production of these enzymes, especially that of diastase, was investigated by scientists both by directly observing the histological changes in the cell contents during the germination of the seeds and also by examining the vitality possessed by different parts. Three parts of the seeds are essentially concerned in the production of enzymes during their germination viz. embryo, endosperm and aleurone layer. Evidences are strong to show that the epithelial layer of the scutellum secretes diastase; but the results of the previous investigators are contradictory with regard to the enzyme secreting capacity of the endosperm and the aleurone layer.

Historical. The consideration of the possession of vitality by different parts of the seeds is essential, since the secretion can take place only in living and growing parts and not in those parts which do not possess cellular organisation. From the investigations of Bonnet (1754), Sachs (1859), Gris (1864) and many others, it is difficult to judge whether the endosperm possesses vitality or not.

Haberlandt (1894) expressed that aleurone layer is secretory in function. Brown and Morris (1890) are of opinion that the proteid reserve of aleurone layer is used in the late stages of germination. They do not find an appreciable quantity of enzyme in the aleurone layer and its enzymic activity later in germination is due to the accumulation of the same formed during the germination. Stoward (1911) observed that the cytological changes in the aleurone layer were closely similar to those of columnar epithelium in barley. Nuclear and cytoplasmic changes synchronised with these phenomena in the epithelium. This justifies the view that the aleurone layer is secretory in function. Schander Helmet (1935) studied the effects of removing some or all of the aleurone layer in wheat, barley, oat and rice. In rice the removal of aleurone layer proportionately checked the growth so long as there was a connection between this layer and the scutellum, and the breakage of this connection was as good as the removal of the whole aleurone layer. The conclusion of the author is that the endosperm or aleurone layer furnishes a growth-activating substance that passes to the embryo during the swelling stage of germination, and that thereby the embryo is enabled to provide the endosperm with starch-digesting enzymes. From the foregoing literature it is seen that the diastase secretory powers

* Summary of part of the Thesis approved by the University of Madras in 1937 for the award of M. Sc. degree.

of the epithelium of the scutellum is unquestioned whereas those of aleurone cells and endosperm are doubtful.

Material and Method. The previous investigators have been studying this question by following cytological changes in that layer or by noting the changes in the starch grain underlying this layer. In the experiments of Stoward (1911) the different parts were removed and grown in cultures and so these do not represent the conditions *in vivo*. In the following pages, the effect of the removal of the bran on the quantity of diastase secreted is discussed.

The paddy strain, GEB 24 of the Coimbatore Paddy Breeding Station was taken up for study. Husked rice was kept for germination removed at intervals, and kept for drying at 30°C for 24 hours. The seeds were separated into bran, embryo and endosperm and the diastase contents of the different parts were estimated. A blank was run without the starch and the reducing sugars in the material was accounted for before the quantity of diastase was calculated. Twenty-five seeds were taken for each experiment and the separated parts were well pulverised and added to 10 cc. of 1 % starch solution and the reaction was allowed to proceed for one hour at 40°C. The reducing sugars formed were estimated by Schaffer and Hartmann method as modified by Fred, Peterson and Stiles (1926). The quantity of diastase in 100 seeds in terms of mg. of glucose was then calculated.

Experiment 1. In this experiment, husked rice was germinated and then separated into different parts viz, embryo, pure endosperm and bran, and the quantities of diastase present in these three parts were estimated. The data are presented below.

TABLE I. Diastase in different parts of germinating rice seeds.
(Quantity for 100 seeds.)

Hours after soaking.	Embryo.	Endosperm.	Bran.
48	45·68	69·36	16·80
72	42·08	85·92	24·08
96	104·48	139·04	29·68
120	89·28	111·76	49·76

The above results show that with the increase in the period of soaking there is a steady increase in the diastase of all the parts. Embryo and endosperm show a set-back on the fifth day, whereas the bran shows an increase through-out. The bran contains the least quantity.

Experiment 2. In this experiment the bran on the seed was completely removed before keeping them for germination. The seeds show signs of germination and the radicle emerges only to one or two mm.

TABLE II. Quantity of diastase in rice seeds when they germinate without bran.
(Quantity for 100 seeds.)

Hours after soaking.	Embryo.	Endosperm.
48	6·88	13·52
72	3·52	12·56
96	5·36	10·00

This experiment shows that the absence of bran has caused a great decrease in the amount of diastase secreted during the germination of rice.

Experiment 3. In this experiment bran was ringed out near the embryo leaving a large portion at the distal end of the seed but unconnected with the embryo. The analysis for diastase content on the second and third days showed that the embryo contained 3·52 and 3·50 and the endosperm contained 5·64 and 5·36 respectively, in terms of glucose for 100 seeds.

Experiment 4. In this experiment bran was ringed out at the distal end (i. e., away from the embryo) leaving a large portion in touch with the embryo. In this case the seeds germinated well. The diastase contents on the second and third days were : embryo, 44·64 and 53·76 respectively; endosperm. 61·76 and 82·88 respectively. Since the diastase content is not reduced, it is evident that the contact of the embryo with the bran is essential for the diastase secretion.

Experiment 5. In this experiment, the embryo was connected to the bran through the dorsal and ventral veins only. The bran on the lateral sides of the proximal half of the seed was removed. Thus the contact between the bran situated at the distal half of the seed and the embryo was maintained through the dorsal and ventral veins. The seeds germinated well.

TABLE. 3. Quantity of diastase in germinating rice seeds with bran connected to the embryo through the dorsal and ventral veins only.

(Quantity for 100 seeds.)

Hours after soaking.	Embryo.	Endosperm.
48	6·88	14·76
72	11·36	44·16
96	12·56	28·56

The establishment of contact between the embryo and bran has resulted in a liberal secretion of diastase. The reduction in the extent of contact has reduced the diastase content.

Experiment 6. This experiment was planned to find out whether the contact of the bran is essential through-out the course of germination. In the germinating seeds, the bran was ringed out near the embryo, 6, 12, 24 and 48 hours after first soaking and the germination was allowed to proceed further. The analyses for the diastase contents showed, that, the longer the contact of the embryo with the bran, the greater the secretion. Even if the contact is broken 6 hours after soaking, the secretion is fairly large. The diastase content of the bran itself was very small. This shows that the secretion is not essentially in the bran.

Experiment 7. To find out if the bran secretes diastase in the absence of the embryo, the seeds were degermed and germinated. There was practically no increase in diastase.

Experiment 8. Embryos of rice seeds were carefully separated twelve hours after soaking. In one case a small portion of the endosperm was left attached to the embryo, and in another case the endosperm was removed as completely as possible.

TABLE. 4. **Quantity of diastase in germinating excised embryos.**
(Quantity for 100 embryos)

Hours after soaking	Embryo only kept for germination.	Embryo with a bit of endosperm kept for germination.
48	30·08	32·64
72	54 80	72·88
96	59 76	90·40

There is a progressive increase in the diastase content of the embryo even when it is kept alone for germination. When a small portion of the endosperm is in contact with the embryo the secretion is greater.

Discussion. From the foregoing experiments it is clear that the bran plays an important role during the germination of rice, not by the secretion of diastase, but by enabling the embryo to secrete the same. The investigations of Schander Helmet and Brown and Morris show that there is a flow of some material from the aleurone layer to the embryo during the early stages of germination. The above experiments show that the contact of the embryo with the bran is essential only in the early stages and that the bran does not contribute diastase by way of secretion. How the bran enables the embryo to secrete more diastase is not clear.

Diastase is a complex enzyme possessing two components viz., α amylase and β amylase. Nordh and Ohlson (1933) are of opinion that the dormant seeds contain only α amylase while β amylase appears only during the sprouting of the seeds. Recent investigations of Giri and Sreenivasan (1936) show that α and β amylases are both present in the rice seed in an insoluble form in the dormant stage and that they become soluble only during the germination process. They contend that Ohlsson's view that α amylase arises only during the germination of seeds is untenable. Waldtschmidt-Leitz *et al* consider that the increase in diastase during the germination is due to 'amylokinase' or to an increase in the soluble part as a result of proteolytic decomposition.

To test whether the bran layer contained any substance which is capable of rendering the inactive amylases of rice active, the following experiments were conducted :

Since the diastase present in small quantity in ungerminated seed is not soluble in water, it is clear that the bean of the ungerminated seed does not possess any activating substance. Such an activating substance may arise there during the process of germination. Hence the bran from seeds germinated for 3 days was taken. The diastase content of the seeds increases during the first 24 hours of germination but it is not evident in the extract

i. e., the enzyme is not soluble. Seeds germinated for one day were taken powdered, water added and also 0·2 gm. of the bran from the three-day germinated seeds. The diastasic activity was tested after 24 hours. There was no diastase in the extract. This shows that the bran does not play the role of activating the inactive α and β amylase in rice. Probably it supplies some important ingredient to the embryo which enables the latter to do that function.

The solubility of the two amylases in the seeds germinating with and without bran was tested by Venkata Giri's (1934) iodine colour test using agar-starch as substrate. The colours of the rings formed at different stages of germination were tested both by using the materials direct and by taking their water extract.

TABLE V. Giri's colour tests for α and β amylases.

Hours after soaking.	Normal seeds.		Branless seed.	
	Material	extract.	Material	extract.
0	V. W.	...	V. W.	...
24	V. W.	V.	V. W.	...
48	V. W.	V.	V. W.	...
72	V. W.	V. W.	V. W.	...

V. = Violet colour.
V. W. = Violet ring with white centre.

The foregoing table shows that both α and β amylases are present in the seeds even from the beginning, whereas they are not present in the extracts in the initial stages of germination. β amylase becomes active before the α does. Both the amylases are absent in the extracts from the seeds germinated without bran portion. Presence of bran during extraction showed no difference in colour tests. This shows that the bran does not play the role of rendering the insoluble α and β amylases soluble. From Table 5 it is evident that β amylase is first rendered active.

Conclusion. The absence of bran causes a considerable decrease in the quantity of diastase secreted during the germination of rice. The presence of bran on the seed, without there being any contact between this part and the embryo shows the same effect as the complete removal of bran from all over the seed. This shows that the bran sends some important substances to the embryo which enables the latter to secrete diastase abundantly. The contact between the embryo and the bran is not essential through-out the germination period, but if the bran is removed a few hours after the soaking of the seed, the scretion is not interfered with. The longer the contact in the early stages of germination, the larger was the quantity of secretion. The diastase present in the bran is very little and it does not secrete any significant amount in the absence of embryo. Therefore it may be concluded that the bran translocates some important substance to the embryo, which enables the latter to secrete large quantities of diastase. The iodine colour tests showed that the bran did not play any,

part in rendering the amylases soluble; and also that β amylase was rendered soluble first.

Summary. The experiments have definitely proved the importance of bran during the early stages of germination. The break in the contact between the embryo and bran has the same effect as the complete removal of bran. The translocation of substance from the bran to the embryo takes place within six hours after soaking of the seed. β amylase is rendered soluble in water first and later only the β amylase is rendered soluble.

Acknowledgments. This investigation was undertaken under the auspices of the University of Madras. I am grateful to my professor Mr. K. Ramiah, M. B. E., the then Paddy Specialist to the Government of Madras for suggesting the problem and guidance in my work. I am also indebted to Mr. P. V. Ramiah, Government Agricultural Chemist and Mr. P. D. Karunakar, Agricultural Bacteriologist for having given me facilities in their laboratory for carrying on the investigations and to Mr. T. Rajagopala Iyengar for helping me in the course of the experiments.

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Tea Cultivation in South India *

By E. A. STONE,

Manager, Gajammudi Estate, Anamalais.

(*Concluded*).

Pests and Diseases. There are many diseases which attack tea and nearly all are fungal parasites. The fungal root diseases are the worst as they almost always kill the bushes they attack; so I shall describe some of these first.

Root diseases. The commonest root diseases in South India are probably *Ustulina zonata* and *Fomes lamaoensis.* The former fungus grows freely on dead Grevillea (silver oak) stumps and from them passes on to living tea bush roots along the lateral roots of the Grevillea so that often where a dead Grevillea tree has not been properly rooted out a patch of several dead tea bushes will be found round about it. In such a case the best way of stopping the disease spreading further is after carefully rooting out Grevillea stump and dead tea bushes and all their roots, to ring the infected area with a 2 foot deep trench, throwing the earth from the trench inside the ring. This is the most efficacious treatment for any root disease. When single dead bushes are found they and all their roots are carefully removed and burnt. Various chemical treatments have been tried, but have never proved to be of any real use. Years ago before it was discovered that lime was bad for tea, the soil around a diseased area was heavily limed in the mistaken belief that this would kill the fungus. Ferrous sulphate is sometimes used but has not been proved to do any good The best way to keep root diseases under control is to have a system whereby bushes showing signs of disease are rooted out immediately. This cannot be done by putting on a few coolies to search up and down each field once a month, which is the haphazard method employed on many estates. There must be a system by which one or two men with digging tools accompany each gang of pluckers, and the pluckers and plucking maistries are trained to call them and point out dead or dying bushes. In this way, diseased bushes should not be missed and would be removed weekly so reducing the chances of fructifications forming on the dead wood and spores becoming distributed.

In the case of *Ustulina* the fungus does not spread through the soil but spreads from root to root when in contact. It shows up as black rings inside the bark in a transverse section of a diseased root, and in brownish patches when the bark is peeled off longitudinally. *Fomes* can be recognised easily from the way the mycelium causes a crust of earth to adhere to the

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outside of the diseased root. Inside the root the disease shows up as a honeycomb of brownish orange markings. Another fairly common root disease is *Rosellinia arcuata*. This shows up as a black spongy mass on the outside of the bark of the diseased root, but penetrates through the bark and forms large white star shapes, which are clearly visible between the bark and the wood.

Several other fungi have been shown to attack and kill the roots of tea such as *Diplodia*, *Poria*, other species of *Fomes* and *Rosellinia*, but these are uncommon. There is also a fungus which attacks the newly formed rootlets of germinating tea seed and causes them to drop off.

Stem Diseases. Various fungi attack the stems of tea bushes causing canker and 'die back' but do not usually kill the bush. Bad cankering occurs on the upper surfaces of the main branches, spreading up from the centre of the bush and finally continuing as holes running through the centres of the branches. If the canker gets very bad it is necessary to collar-prune the bush. Other types of canker show as splits in the bark caused by the fungus penetrating as far as the cambium layer of the stem and killing it in patches. 'Die-back' is the popular name given to the diseases which attack the branches of a bush from their green tips and cause them to die right back to the centre. Usually outer branches are attacked first. Occasionally every branch of a bush will become infected and the whole bush has to be removed. These diseases are usually ascribed to species of *Nectria*. There are various mild blights which do little or no harm, and such epiphytes as mosses, liver-worts, and lichens cover the lower stems, and are cleaned off at each pruning. A very weak solution of caustic soda is sometimes used for this cleaning, but usually the plants are removed with just a damp piece of cloth or sacking.

Leaf and stem diseases. An algal disease which has caused extensive damage in North India has been found in South India, but its ravages do not seem to be so severe in the hill districts. This is 'red rust' (*Cephaleuros parasiticus*) which can be recognised by a fur of little red hairs on the green stem and leaves. These are the sporangiophores of the alga which have pushed through the epidermis. The worst leaf and stem disease in S. India is probably 'Black rot' (*Corticium*). This fungus spreads over the stem and the leaves of bushes, causing the leaves to blacken and rot and finally after a period to fall off, the rotting leaves tend to stick together. Whole patches of tea become infected with this disease during the heavy rains and present a blackened rotting appearance, but when drier weather and bright sunshine return, the dead leaves fall off, and new buds appear, and soon the bushes can be brought back into plucking. On some estates gangs of labourers are put on to collect off all the dead leaves and blackened twigs and to collect the fallen diseased leaves and burn the lot. As the fungus is present on the bigger branches also this method cannot eradicate it. Nor is it possible to spray infected bushes with the usual fungus killing copper sulphate sprays (Bordeaux or Burgundy

mixtures) as the attacks occur during the heaviest rains. It is the writer's confirmed opinion that the best way to treat the disease is to leave it severely alone, making the pluckers also avoid touching the bushes when passing through the fields. The writer has adopted this policy for the last three years, and during this last South West Monsoon there was nothing like the amount of black rot on his estate that there was on surrounding estates which have spent Rs. 300 to 400 a year for the last four years on collecting and burning. Probably the best plan would be to mark the infected areas at the time of infection, and spray the bushes all over with Bordeaux mixture as soon as the weather makes this feasible.

Leaf Diseases. There are various blights which attack the leaves of tea in S India, but these do very little damage to mature tea bushes as they only seem to attack a few leaves here and there. Grey Blight (*Pestalozzia Theae*) turns the attacked leaves grey, Brown blight (*Colletotricum Camelliae*) turns them dark brown, Copper blight (*Gingrardia Camelliae*) to a copper colour which later fades to grey, Sooty mould (*Meliola*) covers the leaves and twigs with a black powdery mould. This last named is dependent on the presence of insects, but seems to do no harm to the bushes. It looks ugly, and it seems to have spread in the Anamalai district a lot in recent years. While these blights do no harm in old tea their ravages in nurseries become serious if not checked by spraying.

Animal Pests. The most serious of these is undoubtedly eel worm (*Heterodera marioni*) in tea nurseries (see the first article on nurseries). This parasite is present in sour water-logged soil and will kill off eventually all the plants in a nursery if it once gets in unless the uninfected plants are quickly removed (i.e. in the case of a basket nursery) to another situation.

Termites eat away decayed wood on tea bushes, but one species will attack the living tissue also, eventually hollowing out the entire inner frame work of the bush right down to the main tap root. This species is *Calotermes militaris*. Because of the ravages of termites in buildings most planters pay half an anna or even an anna for every nest brought in, and by this means hundreds of nests are destroyed annually per estate, and the pest has considerably decreased.

Another pest that does a certain amount of damage is the shot hole borer, which bores a neat round hole straight down the centre of the branches. Its presence is usually only discovered at the time of pruning, when the affected branches should be pruned further and further down until the parasite is found and killed.

There are other parasites such as other boring grubs, worms, bag worms etc. but these do little or no damage.

While there are many more pests and diseases of tea, the writer has included in this article only those which he has seen and identifed himself, and considers these are sufficient to show that a good deal of care and money have to be spent on pest and disease control work.

I wish to close this final contribution by thanking the editorial board for requesting me to write a series of articles on the subject of Tea cultivation and for finding space in the *Madras Agricultural Journal* for my elementary efforts at giving some idea of tea cultivation to those who previously knew nothing of the subject.

The Annamalai University Colonisation Scheme.

By C. S. KRISHNASWAMI, L. Ag.,

Agricultural Demonstrator, Chidambaram.

Introduction. In India, agriculture absorbs and provides employment to millions of our people. With a view to find out whether scientific farming would provide a decent income to the educated unemployed, Rao Bahadur Sri. M. R. Ramaswami Sivan, Retired Principal, Agricultural College, Coimbatore, made a special study of the colonisation scheme in progress in the Punjab. He had the opportunity for this study, when he visited Lyallpur. In the Punjab, extensive areas with irrigation facilities are available and such lands were assigned to graduates who were willing to colonize them and make agriculture their profession. The initial assignment of land was on a temporary basis but with the proviso that if the lands were properly cultivated and the colonies were kept in sanitary condition, permanent occupancy rights might be granted to the lessees any time after a period of 5 years The first batch consisting of 48 graduates from Arts, Science and professional colleges started the colony in 1932 and is still continuing as colonist farmers.

The Colonization Scheme. The impression created by the efficient working of the scheme in the Punjab made Rao Bahadur Ramaswamy Sivan enthusiastic to try a similar scheme for the benefit of the graduates and other educated men of this province. As a member of the Syndicate, he persuaded the Annamalai University to give a trial to a similar scheme utilizing the cultivable lands belonging to the University. The University permitted Mr. Sivan to start the scheme and allotted 100 acres of its lands rent free for this purpose. It also agreed to provide residence for the colonists and bear the cost of the permanent improvements to the lands. But it was not prepared to advance any sum to meet the cost of the live and deadstock, working expenses or the subsistence allowance to the colonists.

To find funds for the above purposes, a Co-operative society was formed and registered on 2nd May 1938 with the Vice-Chancellor and Registrar of the University as the ex-officio President, and Secretary respectively. Sympathisers of the scheme were also made eligible to become members of this Society and as many as 20 gentlemen have taken shares to the extent of Rs. 510, (at Rs 5 a share) Graduates of the Universities and other educated unemployed men who have at least completed their Secondary School Leaving Certificate and who are not below 18 years of

age were eligible to become colonist members. The candidates selected as colonists were to take at least 20 shares of Rs. 5 each payable in five quarterly instalments. They should also bind themselves to serve for five years in the first instance and must abide by the bye-laws of the Society. As the University cannot part with the lands to the colonists at any time or grant permanent occupancy right to any body, the scheme was intended to train the educated men for the profession of agriculture. These may later on be absorbed when the Provincial Government start any such scheme in the areas reported to be available as cultivable wastes in the several parts of the Presidency.

Initiation of colonization scheme. At the time of starting the scheme, four graduates joined the Society as colonist members but only two of them were able to take up the work. These two graduates have continued to do their work cheerfully for the last two years.

Based on the first year's experience, the bye-laws of the Society were considerably altered in the second year and are at present being considered for registration by the Registrar of Co-operative Societies. According to the original bye-laws, the individual colonists were made to share the profit or bear the loss in cultivating the land. The society was merely to act as a lending institution recovering the loan or advances given to the colonists at the end of the year. The main changes now made are that the Society as a whole instead of the colonists individually is to cultivate the lands and raise the crops, the colonists acting on behalf of the office bearers and under their instructions. Secondly, the remuneration to the colonists is to be fixed according to the net income from the crops raised each year and should be treated as a regular expenditure of the society before working out its annual profit and loss account. Another important change in the bye-laws makes provision to enable the colonists to leave the society on certain conditions if they are obliged to do so before the stipulated period of five years.

Just before starting the scheme, a small committee was appointed by the University to work out the details of the cropping etc. The committee included experts like Rao Bahadur M. R. Ramaswami Sivan, Nawabzada Saadat Ullah Khan, Deputy Director of Agriculture, Mr. R. N. K. Sundaram, Assistant Director of Agriculture and a few others. They prepared an estimate for equipping a farm of 100 acres with live and deadstock and also a cropping scheme. According to their scheme each colonist is to be allotted 8 acres of wet lands and 2 acres of garden lands.

Working of the scheme. The actual work was started in June 1938. The two colonists who were non-agricultural graduates were given a fortnight's training at the Palur Agricultural Research Station. Their farm was equipped with four pairs of cattle costing Rs. 225, a few country ploughs and tools like mammatties and sickles at a total cost of about Rs. 46. An area of 18·65 acres of wet lands and 1·50 acres of dry lands was cultivated during the first year. Paddy followed by black and green grams were the

crops raised in the wet lands. Tobacco, groundnut, vegetables, fodder cholam and plantains were the important crops in the irrigated dry lands. Two permanent coolies were engaged by the colonists to help them. The department of Agriculture provided them with a maistry for help in their day to day routine. The local Agricultural Demonstrator was instructed to visit the colony periodically and render them all possible help. (The statement of receipts and expenditure extracted from the audit report for 1938—39 is given in Appendix A. A similar statement for 1939–40 is given as appendix B.)

Results of two years work. It may be too soon to judge the ultimate success or failure of the scheme from the results of the past two years. In the first year the society incurred a loss of Rs. 350. This is due to various causes. The wet land that was available for cultivation had been lying uncultivated for a number of years before allotting it to the colonists. It was overgrown with *babool* trees and shrubs of various kinds. These had to be uprooted and removed and a lot of earth work had to be done before levelling the land and bringing it into a fit condition for cultivation. The colonists began the work late in the season, no cattle manure was available for purchase and the crops had to be raised without any manure. Paddy therefore raised in 18·65 acres gave a poor yield of 1260 lb. per acre. Black and green grams had also showed a poor stand. Among the garden crops, tobacco and tomato did well and brought in some profit. Due to the absence of rains, dry groundnuts failed. A perusal of the accounts shows however that the results of the second year were encouraging. But the accounts included the subsist nce allowance granted to each colonist at Rs. 15 per month and the expenditure on live and deadstock and the permanent improvements. Deducting all these and allowing for depreciation on the live and deadstock, there was a gain of Rs. 298—13—2 against a loss of Rs 357 15 0 in the previous year. Thus the colonists were able to get an average monthly income of Rs. 27—10 each, from a total area of 32 acres of wet lands and about 1·50 acres of garden lands It is true that such a poor income will not attract more colonists and may even puzzle the sympathetic critics.

Difficulties met with in working. Since the University could not finance the scheme, the society had not enough funds for the purchase of manures etc. in time and to do the agricultural operations as advised by the Agricultural officers. The encouraging results of the second year were mainly due to the adoption of two simple improvements viz. thin nurseries and economic planting. To get better returns, money crops have to be grown in the garden lands extensively. Unfortunately the water in the ponds dug in the garden lands was brackish and the crop did not come up well. To give a convincing example, 200 plantains in that area were irrigated with the pond water while a similar number was left unirrigated. Within 2 or 3 months, all the irrigated plantains died while the unirrigated ones survived and are at present yielding. The University was approached

again after about $1\frac{1}{2}$ years, detailing all the experiences gained so far. The Vice-chancellor and the other executive officers have been watching the progress of the scheme from its inception and have now come forward to help the society by giving an advance of Rs. 700 every year to be repayable at the end of the season. They have also recently sanctioned a fairly large sum to build residential quarters, cattle shed, store room etc. for the benefit of the colonists. The Director of Agriculture when he recently visited the colony suggested the diversion of fresh water from a drainage channel nearby, to irrigate the garden lands. This scheme is being investigated by the Engineering staff of the University. If it materialises, definitely better results, comparable to those of the Punjab scheme, can be expected. A beginning has also been made to cultivate sugarcane in a portion of the wet lands. The stand of the present crop is good. The results of the second year have been a definite advance over those of the first year. Since the University has come forward to advance the required amount to meet the cultivation expenses, it would be possible to cultivate the crops systematically and adopt the improvements advocated by the department to a greater extent than in the previous years. There is therefore no ground to doubt the stability of the scheme in the future.

An appeal to Agricultural graduates. The Scheme is the first of its kind in Madras and is a unique venture started mainly through the untiring efforts of Sri Rao Bahadur M. R. Ramaswami Sivan, ex-Principal of the Agricultural College. As the two colonists who offered to work the scheme were non-agricultural graduates, they had to seek and obtain far more technical help than would have been necessary, if agricultural graduates had offered themselves to work the scheme. It is a pity and an irony that agricultural graduates failed to respond to work a pioneer scheme of this kind for which they were most fitted by training. The society is prepared to admit a few more colonists and it is hoped that a few ex-students of this Agricultural College, would come forward to work the scheme more successfully and demonstrate to other educated men that farming, if done on scientific lines is always a paying proposition. They would thus enhance the reputation of their *Alma Mater* and prove to the outside world that a degree in agriculture counts in life's struggle and enables one to make a decent living, even under depressing circumstances.

Acknowledgements. I take this opportunity to acknowledge the help given by the colonists and the officers of the University by furnishing me with the relevent particulars and figures needed for this note.

STATEMENT A.

Receipts and Expenditure during 1938—39.

Expenditure.

		Rs. a. p.
I. Expenditure on permanent improvements to be done by the University.		83 6 7
II. *Capital Expenditure.*		
Livestock	221 9 0	
Deadstock	90 11 0	
	312 4 0	312 4 0

III. Kist paid by the University		114 0 0
IV. *Working expenditure in cash and in kind.*		
Seeds and plants	76 0 10	
Manures	30 7 6	
Cooly labour	458 0 2	
Maintenance of cattle	156 2 10	
Miscellaneous cultivation expenses	15 5 0	
Subsistance allowance to the two colonists both in cash and in kind	390 0 0	1,126 0 4
Grand total		1,635 10 11

Receipts.

By sale of vegetables	36 9 0	
„ milk to the colonists	29 12 0	
By value of green gram	19 8 3	
„ black gram	7 0 0	
„ groundnut	5 3 0	
„ straw	81 0 0	
„ tobacco	60 0 0	
„ paddy	600 14 6	
Donation in cash and kind	117 4 0	957 3 6

STATEMENT B.

Receipts and Expenditure during 1939—40.

Expenditure.

1. Expenditure on Permanent Improvements to be borne by the University,		27 2 6
II. *Capital Expenditure.*		
Livestock	47 0 0	
Deadstock	70 1 9	
	117 1 9	117 1 9
III Kist on the lands paid by the University		200 0 0
IV. *Working expenses.*		
Seeds and plants	91 12 10	
Manures and chemicals	35 0 0	
Wages of labour	579 9 6	
Maintenance of cattle	133 11 7	
Miscellaneous cultivation expenses	25 11 7	
Subsistance allowance to the two colonists	364 10 7	
	1230 8 1	1230 8 1
Total		1574 12 4

Receipts.

By sale of milk to the colonists	30 0 0
„ vegetables	32 11 9
„ plantains	4 4 5
„ paddy seedlings	25 10 0
„ groundnut	1 4 9
„ straw	5 0 0
By value of 2 kalams and 3 marakals of blackgram at Rs. 5—0—0 per kalam.	11 4 0
„ 34 kalams and 3 marakals of green gram at Rs. 3—4—0 per kalam	111 5 0

By value of 233 kalams and 5 marakals of Adt. 2 and 8 paddy at Rs. 2 per kalam	466 14 0	
„ 560 kalams of Adt. 17 and PLR 1 paddy at Rs. 1—12—0 per kalam	980 0 0	
„ 800 bundles of straw at 6 per rupee	133 8 0	
„ tobacco	26 3 9	
	1828 1 8	1828 1 8

STATEMENT C.

Profit and loss statement.

Details.		Sub-total.	Total.
1938—39.		Rs. A. P.	Rs. A. P.
Share of permanent improvement 10%		8 5 5	
Depreciation on livestock 25%		55 9 9	
„ deadstock 12%		11 3 0	
Kist paid by the University		114 0 0	
Working expenses as in statement A		1126 0 4	1315 2 6
Less receipts as in statement A			957 3 6
Net loss			357 15 0
1939—40.			
Receipt as in statement B.			1828 1 8
Expenditure:			
Share of permanent improvement			
1938—39	8 5 5		
1939—40	2 12 0	11 1 5	
Depreciation on livestock 25%			
1938—39	55 9 9		
1939—40	11 12 3	67 5 9	
Depreciation on deadstock 12%			
1938—39	11 3 0		
1939—40	8 12 3	20 5 3	
Kist paid by the University		200 0 0	
Working expenses as in statement B		1230 8 1	1529 4 6
Net expected gain			298 13 2

Average monthly income per colonist.

Subsistance allowance given to the two colonists		364 10 7
Net expected gain		298 13 2
		663 7 9
Average monthly income	$\frac{663\ 7\ 9}{2 \times 12}$	27 10 3

Skew Bolls in Cotton.

By L. NEELAKANTAN, M. A,

Assistant to Cotton Specialist, Koilpatti.

Introduction. In 1939-40 a few cotton bolls were observed in a bulk field of K. 1 (a strain of *Gossypium arboreum* L., var *neglectum* forma *indica*, evolved at the Agricultural Research Station, Koilpatti) which differed from the normal in displaying a characteristic skewness in their external configuration. Examination of these skew bolls revealed that some of the ovules had not developed. These defunct ovules reduce the potential yield of the cotton plant, and thus cause an economic loss. A similar observation was made by the writer in N 14 (another strain of *Gossypium arboreum* L., var. *neglectum* forma *indica)* at the Agricultural Research Station, Nandyal in 1938-39.

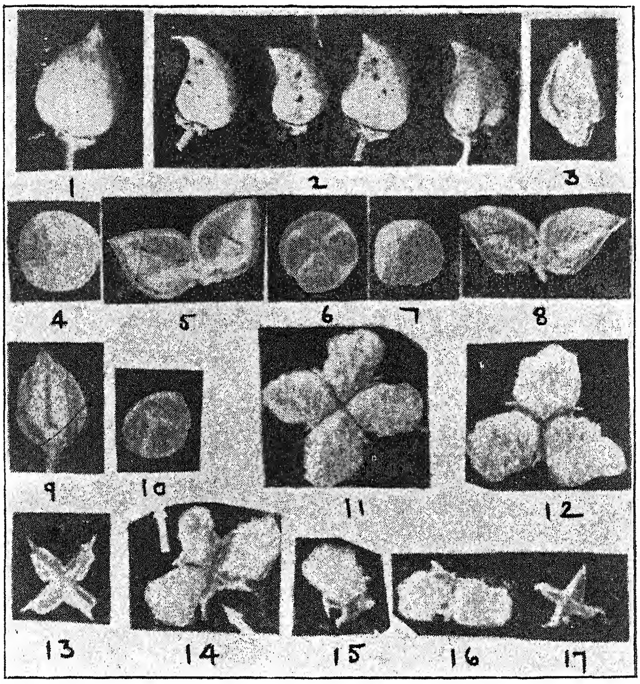
Investigations into the nature and causes of such an intensely localised non-development of ovules, its relation to boll shedding and its seasonal and varietal peculiarities were commenced at the Agricultural Research Station, Koilpatti, in 1939-40. A few interesting conclusions were arrived at in regard to the origin of skewness.

Observations. Uniformity in the development of all the ovules situated in a line in the multilocular ovary of the cotton boll appears to be a necessary condition for determining its shape and symmetry. It is found that the occurrence of a few undeveloped ovules at random in a mature boll does not cause any change in shape, but their presence in a series alters it. (Plate I figs. 1—17).

In fig. 1—3 are shown a normal boll, some skew bolls and a skew boll dissected exposing two locules with suppressed ovules. Fig. 4—10 show the internal morphology of a normal, and a skew boll. Dehisced fruits of normal and skew bolls are shown in fig. 11—17.

Skewness becomes visible when the boll is about a week old, and persists till maturity. The suppression of the ovules takes place commonly in one or two locules and occasionally in three. In all cases the ovary wall opposite the functionless ovules is atrophied, due possibly to the absence of the internal pressure generally developing in a normal locule with growing seeds. The wall is soft to the touch, and yields to gentle pressure testifying to the hollowness inside.

The skew boll is not the result of insect or fungoid disease; neither is it a freak. Its occurrence is fairly common. Random examination of 897 bolls in a bulk crop of K. 1 on a single day prior to the commencement of bursting showed that 30 bolls were skew (3·4%). The percentage was more in bolls from selfed plants. Eighty-eight out of 1,185 selfed bolls examined on the same day were skew bolls (7·4%). When classified according to



SKEW BOLLS IN COTTON

Figs. 1—17. 1. Normal boll; 2. Skew bolls; 3. Skew boll cut longitudinally; 4. Normal boll; 5. Normal boll split lengthwise; 6. Same cut across; 7. Skew boll; 8. Same split lengthwise; 9. Skew boll with aborted locule exposed; 10. Skew boll cut across; 11. Four-loculed normal boll; 12. Same three-loculed; 13. Normal four-loculed boll with kappas removed; 14. Four-loculed boll with one locule abortive; 15. Four-loculed boll with three locules aborted; 16. Three-loculed boll with one locule aborted. 17. Four-loculed skew boll with kappas removed.

[illegible] manure
get big[illegible]

locular composition it was noticed that the skew bolls were more in four-loculed bolls (10·3%) than in tri-locular bolls (3·8%). Cotton flowers are found to exhibit variations in contabescence from complete sterility of the androecium to degrees of sectorial contabescence. A hundred flowers with perfect anthers, a hundred with anthers showing sectorial contabescence and fifty flowers with complete sterility of anthers (practically pistillate) were at the time of flower opening tagged during mid-flowering season for study of the morphology of boll shape. Care was taken to see that the flowers were not unduly shaken while tagging. All the 39 bolls that developed from the first set of flowers were normal in shape. Out of 28 bolls that matured in the second set, six (21·4%) were skew. In the third set only seven bolls developed of which two (28·6%) were skew.

Experiments. A more definite evidence was obtained in an experiment on artificial pollination. Pollen grains were gathered on the hairy margins of torn off leaf bits and dusted on the lower regions of the stigma of emasculated flowers on the day of flowering at about 11 a. m., when the stigma was highly receptive. The pollen grains were then carefully distributed thinly and evenly on some of the stigmatic faces, while on others, no grains were left. With a powerful hand lens the number of grains thus deposited were counted and the lobes that had not received any pollen were also checked. A faint pin scratch was made across the line of dehiscence of the dusted lobe with the object of creating a permanent scar to facilitate identification later. The dusted flowers were enclosed in paper bags which were fastened in such a way as to avoid the possibility of the stigma rubbing against the paper. The stigmas were re-examined next morning to make sure that no pollen had strayed to the non-pollinated lobes.

Flowers in which all the stigmatic lobes were dusted, developed normal bolls, but those with a few lobes pollinated grew into skew bolls. It was therefore apparent that the pollen tubes developing from grains deposited low on the stigmatic lobes travelled down straight, entered the corresponding locule, and fertilised the ovules inside. The ovules in the other chambers did not get any pollen tubes and remained unfertilised causing skewness in the developing boll.

Discussion. A similar observation on the pollen tubes was made by Doak (1937) in a study on pistil anatomy in relation to experimental control of fertilisation. He remarks that though the arrangement of the pistil tissue "does not preclude the possibility of pollen tubes switching from the stigma of one carpel to the ovules of another during descent it is such as to disfavour this transfer. This is especially true of tubes grown from points low on the stigmatic lobes".

In the field, the stigma in the flower of K. 1 is well above the staminal column and the first part to get pollinated automatically is the basal region. Insects and wind tend to distribute pollen further up later in the day. Such a type of distribution is not possible in flowers which are selfed. Examination of 700 flowers on a single day in K. 1 bulk during mid-flowering

showed that 8 per cent were fully contabescent. These invariably shed when selfed. About 22 per cent were sectorially contabescent. In these flowers the stigmatic lobes near the contabescent portions of the androecium have no chance of self-pollination. But insects crawling about the stigma unwittingly effect a scattering of the available pollen all over, and thus will counteract the tendency towards skewness. In the absence of such an agency such flowers develop skew bolls On selfing, the sectorially contabescent flowers produce skew bolls invariably. Thus, while skewness is facultative in open pollinated flowers it is obligate in selfed flowers. It is not improbable that the 3·4 per cent of skew bolls observed in nature is due to the fact that the flowers from which they matured are all sectorially contabescent and are not visited by insects. The selfed flowers suffer from a disadvantage in that the contabescent flowers do not have a chance of pollination by insects This may account for the numerical preponderance of skew bolls from selfed flowers over those from open pollinated flowers. The conclusion drawn is that skewness is brought about by the non fertilisation of ovules in particular locules.

Further studies into the causes of the skewness are in progress and their results will be discussed in another paper.

Acknowledgments. This study was first undertaken at the Agricultural Research Station, Nandyal during 1938—39 and continued at Kovilpatti. My thanks are due to Messrs R. Swami Rao and R. Chockalingam Pillai, Asst. Director of Agriculture, Kurnool and Thirunelveli respectively for permitting me to undertake this investigation and to Mr V. T. Subbiah Mudaliar for his kind suggestions and criticisms during the preparation of this paper.

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Palmyra Fibre Industry.

By A. SANKARAM, B. Sc. (Ag.)

Introduction. In many of the villages of the Vizagapatam district extraction of palmyra fibre is an important cottage industry. The industry is fairly an old one. As a typical cottage industry it provides sufficient employment to the ryot during his spare time and supplements his income from cultivation. Of the different sources of brush fibre, the palmyra palm is easily the cheapest as it grows extensively on waste dry lands and on many field bunds. The technique of extraction is simple and does not involve the use of any costly appliances.

Narasimham (1) has dealt about the industry with special reference to Golukonda taluk of the Vizagapatam district. In the present article an account of the different phases of the industry is given, with particular reference to the economic aspect. The industry is mostly concentrated on

the east coast of the Presidency. The three districts, viz., Vizagapatam, East and West Godavaries, chiefly supply the raw material to the several factories located along the coast. The supplies are more or less regular throughout the year, but usually there is a slight increase during the dry months :— i. e. December to June. It is only during this period that a ryot can take it up as a side industry without prejudice to his main occupation.

Extraction of fibre. Leaf sheaths (basal portion of the leaf stalks) of palmyra palm trees are cut in lengths varying from 20 to 26 inches. They are split into two and the sharp edges and the thin layer of the inner side are removed. The portion remaining is beaten while it is wet with a wooden hammer on a hard floor, until the fibres get separated. They are then combed through sharp tines fixed to a flat wooden plank in two alternating rows of six each. The preliminary combing is not perfect as a part of the non-fibrous material still adheres to the fibres. The combed stuff is next bundled and taken to weekly shandies for sale.

Preparation for the factory. The local dealer who purchases this crude stuff gets it thoroughly cleaned, combed and dried in the sun. It is next graded into two classes—the thick black and the thin brown. Each class is separately made up into small bundles of 2 to $2\frac{1}{2}$ inches in diameter. The material is then ready for transport to the factory.

The process at the factory. The material received at the factory is subjected to a lengthy process before it is made ready for export to foreign countries. Preparation of dye solution* is an important item in the whole process. There are different dyes used by different factories, but in main all the factories use a mixture of Cutch (an inferior variety of catechu), Congo red (a patent dye preparation), and Myrobolan (*Terminalia chebula*). The fibre is then steeped in an iron receptacle, containing the dye and boiled for about 12 hours. The stuff is then removed and heaped on the floor. It is allowed to remain for about 3 to 4 days, in that state, without any further treatment. During this period the fibres absorb the dye. Finally they are dried and bundled.

The bundles are then heaped up in a circular fashion on a floor. The individual fibres are then graded according to their length, combed, bundled, weighed and packed into bales each weighing one cwt., for export.

Export. There is a good demand for the palmyra fibre in foreign countries especially England, Denmark, Japan and France. The standard specifications are fixed by the foreign buyers with reference to the length and thickness of the fibre. The material for export is prepared accordingly. It must be noted that all the material produced has to be exported, as there is no demand for the product in this country.

* Fourteen lbs. of Congo red and 14 lbs. of Myrobolan are added to 100 lbs. of water and thoroughly mixed, the undissolved portions being left in the solution itself. To the above solution are added 2 to 5 tolas of Cutch and about $\frac{1}{2}$ lb. of washing soda.

Quality of the fibre. There appears to be a good deal of variation in the quality of fibre supplied to the factory. This is mainly due to the age and varietal differences of the tree, the soil in which it grows, the method of extraction adopted etc. The longer and thicker the fibre the better the value. An ideal fibre should possess the following qualities :—

1.	Colour.	Black.
2.	Size.	16" to 18" long (fairly thick).
3.	Cleanliness.	Should be free from all extraneous matter.
4.	Moisture.	Completely sun and air dried.
5.	Condition.	Free from all fungus growth.

Labour and wages. The industry gives employment to a large number of labourers, mostly women. Wages are usually paid mostly on a contract basis according to the nature and amount of work turned out. For sorting, sizing and combing of the fibre women are employed who are paid 10 to 14 annas per cwt., according to the quality of the fibre sorted out. A woman can turn out one cwt. of the finished material in about 1½ to 2 days. On an average she earns Rs. 10 per month. All wages are paid in cash only. There are no fixed hours for the women coolies but they do their work in their leisure hours.

Possibilities of a side industry. During December to May, there is very little work to be done on dry lands. Agriculturists and labourers depending on such lands for their livelihood can profitably engage themselves by taking this industry, as a subsidiary occupation. They can take on lease the palmyra palm trees, cut the leaf sheaths, extract the fibre and sell the stuff in the nearest *shandy* where there is a market. On a modest estimate, a family with two adult members can extract 1,200 to 1,500 lb. of fibre in one year which will fetch about Rs. 24/- to Rs 30/-. Deducting one-fourth as the lease amount, the balance can be taken as the net gain. It may, however be stated that considering the profits earned by the middlemen and the factory owners, the remuneration received by the primary producers is very inadequate. From the view point of the primary producer, the industry provides him with some kind of work for his leisure hours and a small source of income in cash.

Acknowledgement. I wish to take this opportunity to express my grateful thanks to Sri. T. Nataraj, B.A., B.Sc (Ag.) for his constructive criticism and valuable suggestions on the paper.

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SELECTED ARTICLE

The Preparation, Sowing and Care of Cigarette Tobacco Seed Beds.

By W. M. ROGERS,

Tobacco Officer.

It is of the utmost importance that proper care should be taken of seed beds, in order to produce a successful crop of tobacco. No detail should be overlooked and no operation imperfectly done in raising the young plants to the planting out stage. For the successful growing of a uniform crop of tobacco, every endeavour should be made to obtain uniformity in size and strength of the seedlings to be transplanted. The site selected should be a well-drained land, close to a permanent supply of water. The same site should be used only one year and then rested at least for two years The site should be away from big trees which have extensive root systems and too much shade. An eastern or north-eastern exposure is best, as the early morning sunshine is very desirable for the plants.

The seed beds should have an abundance of available plant food at the time the seed germinates and a sufficient supply to maintain steady growth of the seedlings during the period they remain in the beds First of all the site should be cleared of weeds and rubbish. The area cleared should be in excess of the actual area required for the nurseries. Then the land should be ploughed once, about a month before the actual nursery operations begin. After the first ploughing a fairly heavy dressing of well-rotted farm-yard manure should be broadcasted evenly and the area ploughed again some time before the final operations commence. After this the site should be well levelled and eventually lined off into beds with broad shallow drains between the beds to serve as pathways. Fairly deep open drains should also be cut around the four sides of the site.

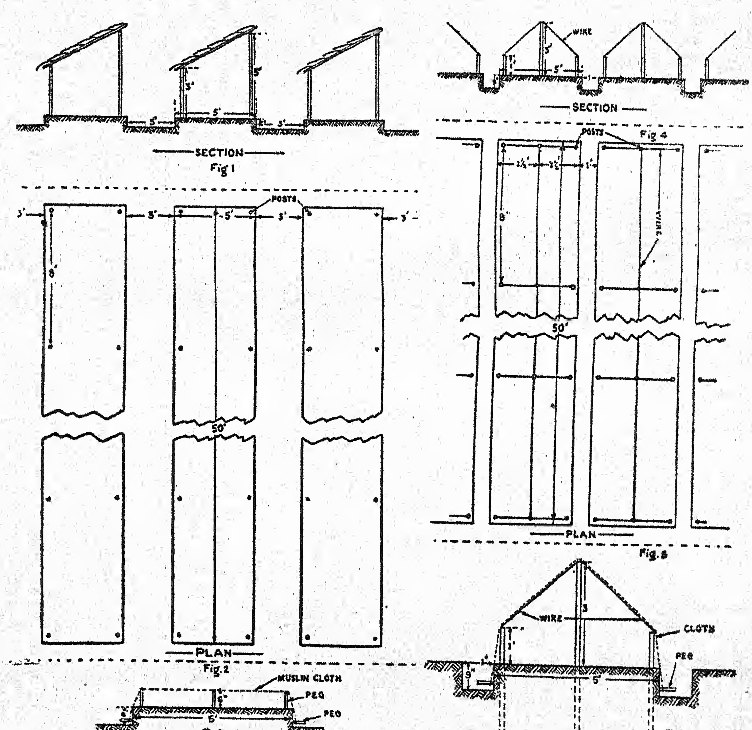
It has been found very convenient to carry on operations and handle plants in beds which are 5 feet wide and 50 feet long with a shallow drain 3 feet wide between the beds.

On opening the pathways between the beds the top-soil should be thrown on the beds. Each bed should then be brought into fine tilth and properly levelled prior to being sterilized. If the soil is too dry it is essential to water the beds and then work the soil into a fine tilth with weeding forks.

The beds should be well sterilized to a depth of 3 inches by the open fire method. This will destroy the seeds of weeds and also kill the destructive organisms inhabiting the soil. The burning should be done when there is no wind blowing, so that full benefit may be derived from the heat generated by the burning material. The beds are well sterilized by burning maize stumps, sunnhemp stumps or brush-wood and coconut husks placed in sufficient quantities to sterilize the soil to a depth of about 3 inches. Tobacco stalks should on no account be used for sterilizing mainly for the reason that diseased portions of leaves may be left about on the site and infection of the young plants may result. When the beds are properly sterilized the soil will be of light brick-red colour and will be very friable and easily pulverized. To clear any doubts as to the depth to which the soil has been sterilized by the fire, a very simple test can be made by burying a potato about 3 inches below the surface of the soil in the

seed bed before burning and if the potato has been well cooked and the skin peels easily, then the soil has been sterilized.

After the beds have cooled, a fertilizer mixture made up of ½ lb. of nitrate of soda, ½ lb. of sulphate of potash and 1 lb. of super phosphate is spread over each ten square yards of seed bed. This should be lightly dug in, taking care not to bring to the surface any unsterilized sub-soil, the fertilizers and residual ash being thoroughly mixed with the surface soil. The seed beds are now reduced to fine tilth and properly levelled with a hand rake. Now the beds are ready for sowing. Most growers still make the mistake of sowing their beds too thickly Such beds produce delicate and tall plants unsuitable for transplanting. Good and healthy seedlings will be obtained when an ounce of properly cleaned seed is sown in an area of 100 square yards, which should produce enough transplants for 5 acres of field. To secure even distrubution of seed it should be mixed with wood ash, a teaspoonful of seed being mixed with a quart of ash, and sown in a seed bed 50 ft. by 5 ft. This mixture should not be sown in one effort and it is very much better to go over the bed 4 or 5 times to secure an even distribution. If wood ash is not available, light white sand may be used. Sow the seed very carefully, gently press the seed into the soil with a smooth hand board 16 in long and 8 in. wide into which a handle is fixed. Water the bed lightly with a can fitted with a fine perforated rose. The seed beds should be roofed over with movable cadjans supported on a frame of sticks driven into the ground and tied together. The roofs should be about 5 feet high to allow of watering, weeding and spraying being easily carried out.



Plan and section of Virginia tobacco nurseries.

—*Tropical Agriculturist.*

To obtain a uniform germination of seed the beds should be watered regularly during the early mornings, late in the afternoons and, in very hot weather, at any time they show signs of drying off. The beds should be kept moist at all times, but not wet.

According to the area to be transplanted and the size of flue barn and owing to the uncertainty of weather conditions it is necessary to have plenty of seedlings available for a period of at least 8 weeks. It is therefore necessary to have at least 5 or 6 sowings at intervals of 4 or 6 days and to sow at least 4 or 5 times more than required. It is probable that about 30,000 seeds (one teaspoonful) are sown in one bed 50 feet by 5 feet in area, but it is not advisable to count on being able to draw more than 7,000 plants from this area. If germination has been good and when seedlings are about 3 weeks old thinning out should be done. Over-crowding in the bed will produce weak plants. The beds should be covered during the night with cheap muslin cloth to keep off insects. The beds should also be kept free from weeds. Experiments have been carrried out during the past *maha* and present *yala* of growing tobacco seed without cadjan coverings but using a cheap white calico cloth and covering the beds as illustrated. The cloth is sufficiently strong to carry off heavy rains and is stretched across the wires and pegged down at ends and sides of beds at intervals of about 4 to 5 feet. The experiment, which is being continued, so far is proving reasonably satisfactory.

In order to guard against pests and diseases the beds should be sprayed weekly when the leaves of seedlings have attained the size of one's finger-nail with the following mixtures recommended by the Mycological and the Entomological Divisions of the Department of Agriculture (Ceylon).

First two sprayings:—
¼ oz. lead arsenate
1 oz. Bouisol colloidal copper
1/8 oz. Agral
in one gallon of water.

When the plants are fairly big the following mixture may be used:—

½ oz. Lead Arsenate
1 oz. Bouisol Colloidal Copper
1/8 oz. Agral
in one gallon of water.

The spraying should be continued up to the time of transplanting.

During the early stages of growth of the seedlings, the cadjan roof should remain over the beds all day.

The hardening of plants should commence when the plants are about half an inch in height. When the plants come to this height, remove the covers daily during the morning for a few hours, increasing the daily period of exposure until the plants have hardened sufficiently to be left open all day long with no bad effects. Care should be taken not to expose the plants to heavy rains Plants are ready for transplanting in six to eight weeks. The best way to test if a plant is fit for transplanting is by bending it; if it breaks with a snap then the plant was suitable for transplanting. Before pulling the plants water the beds thoroughly and pull plant by plant taking care to pull only the strongest and the healthiest ones. Pack them carefully in baskets and despatch them to the field for transplanting.—*Tropical Agriculturist*, 94 (1940): 365—368.

ABSTRACTS.

Planned Soil Conservation Work in Puerto Rico. *Soil Conservation.* 6 : (1940).

The area of Puerto Rico including the dependant islands is about 3400 square miles and the population about 1·7 millions. With 506·3 people per square mile, she has an average of only 0·48 acre of arable land per head. Eighty percent of the population depend directly or indirectly on agriculture. Though the average size of a holding is about 36 acres, 84 per cent of the holdings are less than this size. Almost all the most important cultivated plants such as sugarcane, coffee, bananas, grape-fruits and cocoanuts are exotic to the island. Farming on steep slopes for several hundred years has brought with it great erosional losses of the soil. In 1935, the Soil Conservation Service made an erosional survey which indicated, the type of soil, the extent of erosion and degree of slope. After a study of conditions of soil and slope along with some of the engineering and agronomic limitations so imposed, eight groupings were made defining the physical characteristics and the recommendations made for preventing soil erosion. For instance in Group I are included slopes of over 1 in 3 and where considering the texture of the soil, there is a possibility of over 75 per cent of the top soil being removed. Crop cultivation is not considered practical for such conditions and instead, their development into pasture or forest is recommended. In Group II, slopes of 1 in 4·5 to 1 in 7·5 are included with a possibility of 25 to 75 per cent of the top soil being removed. Here retirement to pasture or forest is ideal. Considering however the pressure on land, a two-year or longer crop rotation has been established. Tobacco, sweet potatoes, beans, vegetables, and grasses are recommended in conjunction with the regular planting of leguminous green manure crops. Similar recommendations appropriate to the soil conditions and slopes prevailing elsewhere have also been formulated. Two soil conservation Experiment Stations are at work. The one at Mayaguez is engaged in determining the type of grass best adapted for blank cover and finding a food crop that could be grown on these banks in place of the grass cover. (2) Development of a cheaper method of building bench terraces than the hand construction method. (3) Determining the relative values of different types of vegetation, and estimating the erodibility of fallow land and sub-soil. The second Experiment Station at Rio Piedras is making detailed studies of the root systems crown and growth characteristics of grasses. In co-operation with other institutions in the island, detailed experiments relating to the analyses of grasses as to their nutritional value and digestive qualities and a study of the erodibility of soils as related to their chemical and physical characteristics are on hand. It has been found that sweet potatoes were the best of the cultivated crops as compared with various beans to prevent soil erosion to any large extent. Guinea and molasses grasses showed more erosion than any of the cultivated crops such as cane, beans or sweet potatoes. Planting sugarcane in furrows as against the old method of planting in holes was found to entail less of erosion. Trailing indigo (*Indigofera endecaphylla*) is very promising as an erosion control plant because of its numerous roots along both nodes and internodes and because of its dense mat of stems and leaves.

R. R.

Seed Disinfection. *Dillon Weston, W. A. R. and C. C. Brest—Nature* 145 (1940) : 824. Certain proprietory seed disinfectants and protectives which contain organo-mercury compounds as their fungicidal basis are now used for disinfecting seed before sowing. When correctly used they control many seed-borne diseases. In these seed disinfectants the fungicidal salt is often a member of the series

R. Hg. X, where R is a hydro-carbon and X an acidic radical. There is a close relationship between composition and fungicidal power' the toxicity decreasing with the increase of the molecule R. If these salts are applied to, and held by, the grain in over-doses, phytocidal effects are produced. The seed may be killed outright or even if it germinates, further development is abnormal. The tissues of the coleoptile are thickened and roots are stunted. Cell division is inhibited, the existing cells becoming enlarged and multinucleate, either with small nuclei or with large ' giant nuclei ' which are polyploid. It has been found that if the grain shows high initial germination and is superficially dry when dusted, no injury to the grain is likely to result. If such seed has to be stored it should be kept under dry cool conditions with adequate ventilation and no loss of germination is likely to happen for several months. The most important factor that should be noted is the relative superficial moisture of the seed, since such seeds will retain excessive quantities of dust and thus affect germination.

T. S. R.

A New Method for Controlling Irrigation. *Michigan Agr. Experi. Stations Tech. Bulletin* 172.

The apparatus gives a continuous measurement of soil moisture in sites under field conditions without disturbing either the plant or the soil. A continuous measure of soil moisture at various depths reveals the actual moisture conditions at any time thus enabling the practice of a more efficient and economical irrigation. The apparatus consists of an absorption block about the size of a small match box which is buried at any desired depth in the soil. Two insulated wire leads, connect this block to a specially devised portable instrument (a special form of Wheatstone bridge) which measures the electrical resistance of the block. Since the blocks are porous they readily take up moisture from the soil. As the soil dries out the block loses moisture so that changes in soil moistures are followed by changes in block moisture. Further more, the electrical resistance of the block changes in proportion to its moisture content. Hence a change in soil moisture is measured by a change in the electrical resistance of the absorption block. Many absorption blocks can be distributed over the growing area at different depths to provide numerous points of measurement. The use of the new method is simple, no particular skill being required. By means of earphones the resistance of the absorption block may be determined in 20 or 30 seconds. M. K.

Grass Storage in Rainy Regions. Sethi R. L. *Indian Farming* 1 (1940).

Grass grows so abundantly during the rainy season, generally in surplus of actual requirements. One way to utilise the surplus and thereby solve the fodder problem would be to conserve it for use later when fodder is scarce. Grass can be stored in two ways (i) by making hay and (ii) by ensilage. But since, due to the wet weather hay making is difficult, the second method of storage is held to be perhaps the only way for heavy rainfall areas. Ensilaging is not appreciated in the areas where rainfall is light because in the first place surplus grass or green fodder is not available in sufficient quantities for conversion into silage and secondly, due to the bright weather in such areas hay making which unlike silage does not entail any loss of material, is preferred. The following is a summary of the cost of producing silage in different localities.

Place.	Cost of production per 100 lb	Percentage loss.	Remarks.
1. Bombay		15 to 34	1. The cost of production depends on the cost price of the material ensiled and the wages paid to the labour employed.
2. Madras			
a) Pattambi farm	As. 3	30 to 33	
b) Nandyal ,,	,, 8	27	
c) Taliparamba ,,	As. 1½ to 6	22 to 50	
3. Surat farm		4 to 17 in Jowar-Cholam and 17 to 35 in grass	2. The loss in soil seems to vary in different places according to the type of silo and the amount of moisture present in the material ensiled.
4. Tegur farm (Bombay)		5 to 10	
5. Assam		20 to 40	
6. Sind		30	
7. South Thana (Bombay)	As. 9		
8. C. P.	less than 1 anna to 3 annas		
9. N. W. F. P.	As. 6¾ to As. 8		

M. K.

Forcing Mango Trees to Bear Regularly. Lal Singh and Abdul Aziz Khan. *Indian Farming* 1 (1940).

The bearing habit of the mango tree in alternate years is so regular that the "off" and the "on" years can be anticipated almost with certainty, unless of course, it is altered by some unforeseen circumstances such as unfavourable climatic conditions—frost, hailstorm or untimely rain at flowering or some disease or pest. Unlike many other fruit trees the growth in mango is periodic rather than continuous i. e, successive periods of growth alternate with periods of rest. The number of these periodic growths or 'flushes" occuring during the growing season in a year as well as the dates on which they occur and the period over which they extend varies with the variety, climatic conditions cultural practices, age of the tree and the amount of fruit borne by the tree. Growth occurs practically during each month commencing from April and ending with August, and as many as five flushes may be produced during the growing season. The fruit is borne of flower panicles which come out in spring from the terminal ends of the shoots that have grown during the preceding season. The chief points observed are: (a) Usually more shoots appeared in April, May and June flushes than in July and August flushes. (b) The April flushing shoots, fruited in greater number in the following year than the remaining four flushes. This information throws some light on the importance of inducing the tree to produce more shoots earlier in the growing season by modifying the cultural practices (c) Shoots of the same flush did not stop growing at the same time. Some of them ceased growing much earlier than others. The shoots that did not stop growing earlier remained unfruitful in the following year. The wood of the shoots growing and stopping earlier becomes hard and mature and this is very necessary for fruiting. In localities of heavy rainfall the best crop of mangoes

follows a monsoon that closes completely fairly early in the season, provided the crop is not damaged by any other cause. If the monsoon is prolonged, the shoots continue growing late with the result that the wood remains tender and immature and the tree is generally unfruitful in the following year. This observation is confirmed by the successful results obtained by (i) ringing and root pruning the over-vegetative unproductive trees and (ii) by the use of dwarfing root stocks in the case of vigorous growing varieties. Dry summers provided moisture is not a limiting factor, are more conducive to fruiting in the following season than wet summers. All these practices and conditions have the same influence on tree growth in so far as they retard the vegetative growth and induce it to stop earlier. Shoots that flower in one season did not flower at all or flowered in very small numbers in the following year, showing a tendency to bear in alternate years. Therefore, it stands to reason that if, by proper cultural practices, enough shoots are induced to grow along with fruiting in the same year it should be possible to remedy the biennial bearing habit in mangoes and get a regular crop year after year. In years of excessive flowering or fruiting it should be possible to induce vegetative growth also in the tree by partial deblossoming (i. e. removing flower panicles from a certain number of shoots) and thereby bringing about fruiting in the following year. M. K.

A study of coconut seed selection for germination. *Umali D. L. Phil. Agriculturist*, 29 (1940) 296—312.

Thin-husked nuts with an average of 2·9 cm. (thickness of husk) and below germinated earlier and produced more seedlings with more leaves and roots than thick-husked nuts of 3·0 cm. (thickness of husk) and above. Seedlings grown from nuts with a setting percentage of 35·5 per bunch and above germinated earlier and gave a higher percentage of germination. The seedlings produced had more leaves and longer roots than those from nuts obtained from bunches of a low percentage of setting, 18·5 and below. Nuts gathered from heavy bunches of ten or more likewise germinated earlier and produced seedlings which were taller, heavier, and with a much better root system than those from light bunches. The nuts from bunches with a high percentage of female flowerbearing rachillae (50·5 or more) required less time to germinate and produced slightly taller seedlings than those from bunches with a low percentage. Although the lengths of the roots in the two treatments were practically the same, the seedlings in the latter produced less roots and leaves than those in the former. Light nuts weighing 0·95 to 1·35 kilograms germinated much later than heavy nuts (1·85 to 2·45 kilograms) and produced shorter seedlings with less roots and leaves. The position of the nuts on the bunch, such as on the ventral and dorsal sides, had no influence on the time and percentage of germination. The seedlings of nuts from the dorsal side produced more leaves and were heavier than those from the ventral. The seedlings from the ventral side, however, were taller and developed more roots than those from the other lot. The seedlings from the top nuts produced more leaves and roots than those from the bottom. The middle nuts required less days to germinate but gave a much lower percentage of germination than either the top or the bottom. (Author's abstract)

EXTRACTS.

The Coconut Industry.

In the latter half of 1939 the Hon. Maximo M. Kalaw, a member of the National Assembly of the Philippine Islands, accompanied by his technical adviser Mr. Hilarion G. Henares, undertook a special mission abroad to investigate the methods of cultivation, treatment, and marketing of coconut products in coconut producing countries as well as the conditions affecting them in the

principal markets of the world. This report is of special interest to those connected with the coconut industry in all countries in view of the very serious situation now developing within that industry. After briefly summarising the salient points and recommendations, the report is divided into seven parts which deal with the author's visit to the Netherlands Indies, Malaya, Ceylon, France and the United States of America; a proposed Coconut Congress; the copra market in Europe; defibring, spinning, and weaving coir in France; the American market for copra and coconut oil; recommendations; and the effect on the coconut industry of independence. There are also seven appendices. His recommendations are intended primarily to prepare the coconut industry in the Philippines to stand the shocks of political and economic separation from America. He urges that a National Coconut Corporation should be established immediately and that the following steps through that Corporation, or otherwise, should be taken. 1. The improvement of Philippine copra through Government standardization and the establishment of drying plants and coconut centrals. 2. The industrialization of coconut by-products such as the utilization of the husks and shells. 3. The elimination, as much as possible, of the middleman through the establishment of coconut co-operatives throughout the country, and the improvement of credit facilities to coconut planters. 4. The establishment of regular freight and shipping service to foreign countries. 5. The establishment of a Coconut Institute on a Government owned plantation wherein a research and experimental station shall be established exclusively dedicated to the coconut industry. 6. The fostering of greater home consumption of coconut products. These recommendations are to be implemented principally by means of the establishment of small copra driers, large mechanical copra driers and big industrial units for producing finished manufactured products of all kinds from the coconut. It is particularly interesting to note that the small drier specifically recommended is the Malayan type 15 drier, which is the model most favoured by small producers in Malaya. The procedure likely to be followed in the Philippines is that the small farmers in coconut regions will be invited to pledge themselves to dry all their copra in the approved copra driers or copra centrals built by Government and to market their copra through the Government so as to avoid the middle-man. The growers would be carefully instructed how to use these kilns and would be given the option of buying the kilns by means of easy payments New light is thrown on the importance of the coir industry at the present time. Evidence is submitted to show that coconut fibres superior to all other fibres as a raw material for making sand bags owing to its great resistance to rotting which is of particular importance because such bags have to be kept damp. Mr. Kalaw emphasizes that sand bags are required not only for the trenches but also in especially large quantities for the protection of public buildings. In addition he related that coir fibre has now many other important industrial uses which he describes and he urges that the production of coir and coir products should be one of the principal activities of the industrials central which he proposes. It is estimated that the whole plan, covering the remaining six years of the Commonwealth before full independence is reached would cost the Philippines Government no less than P 20,000,000 (Malayan 14,000,000)· This is made up as follows.

5,500 copra driers at P 950 each.	5,225,000
20 provincial centrals at P 82.600	1,652,000
5 national centrals at P 695,000	3,475,000
Coconut institute for experimentation and research	648,000
Loans to planters	9,000,000
Total	P 20,000,000

It has already been approved by the United States Congress that the proceeds of the excise or processing tax on copra and coconut oil entering the U. S. A. accumulated since 1934 which now amount to 200 million pesos, may be used for providing facilities for drying copra and for making loans to planters in the Philippines. It is therefore more than probable that the recommendations made in the report will be adopted.

The Philippine Coconut Industry

(Statistics from Leo Schnurmacher Inc.)

Acreage under coconuts	1,589,000
Total number of palms	121,685,480
Palms in bearing	91,178,800
Total commercial production of copra (Copra equivalents)	850,000 tons.

—*The Coconut Industry*. Report of Hon. Maximo M. Kalaw. Bureau of Printing. Manila (unpriced). Review by F. C. C. in the *Mal.Agri. Jour*. (1940) : 374–375.

Manure as Maker of Humus. In a comprehensive discussion on organic and inorganic manures and their relative effectiveness, Sir E. John Russell, D. Sc., F. R. S., Director of the Rothamsted Experimental Station, England, recently gave some interesting facts about farmyard manure. The oldest and best-known method of manuring the land is to give it farmyard manure, and this is not only very effective but also very safe, said Sir John. A man can rarely go wrong with farmyard manure; the chief trouble is he rarely has enough of it. The first serious possibility of using a substitute came about 100 years ago, when chemists analysed farmyard manure and found out the elements of plant food which it supplied. One ton of farmyard manure contains about 12—16 lb. nitrogen; 13—15 lb. potash, and 5—10 lb. phosphoric acid. For making humus in the soil, farmyard manure is one of the common organic manures that is known to be effective. It alone contains straw, and it is the cellulose and lignin in straw that yields humus in the soil; nothing else is known to give it. Cellulose and lignin by themselves, however, are of no value as manure and may indeed distinctly reduce the crop. The reason is very interesting. Micro-organisms that decompose the cellulose and lignin in order to produce humus require nitrogen and phosphate for their own nutrition, and they therefore compete with plants and take up nitrate and phosphate from the soil. When they die, their bodies decompose and may ultimately produce nitrate once more, so that in the end the crop may not suffer, and in the second year it may indeed benefit. Broadly speaking, cellulosic materials require nearly 1 per cent of their weight of nitrogen to effect their decomposition, and this must either be added or taken from the soil. For this reason, organic materials like paper, sawdust, and wood shavings have no direct manurial value in spite of the presence of cellulose and lignin, though if nitrogen and phosphate are supplied they can be composted, forming a humus material that may improve the soil. Even straw by itself is of no direct value as manure; indeed in its first year it may be slightly harmful, though in its second year it may become useful. The value of organic matter as manure depends on three factors: (1) its percentage of nitrogen; (2) the ease with which it decomposes in the soil; (3) the quantity of cellulose, lignin, and similar substances that it contains.— [Press Note, Dominion Department of Agriculture, Canada *Indian Farming*, September 1940]

Gleanings.

Stability of Vitamin C. Many people have the idea that the ordinary methods of cooking destroy all the vitamins. Two years ago Mrs. Boas Fixen reported that the usual processes in the kitchen are unlikely to cause any significant loss of Carotin, Vitamins A, B_1, B_2 complex or D. Vitamin C is unstable but not so much as has been suggested by various authorities. Recent research has shown that cooked and canned fruits and vegetables do actually retain much of their vitamin. Potatoes if boiled in their jackets retain most of their antiscorbutic properties. The real truth is that much of the vitamin goes into the water used for cooking. It is evident that the liquid used for cooking vegetables should be put into the stock pot or used as a basis for soup. (*Food Manufacture* 15 (*1940*) : 194.

Parthenocarpy. Considerable practical importance is attached to the fact that the ovaries of various fruits may be stimulated to development by foreign pollen quite incapable of effecting fertilization, so that seedless fruits may result. Sadao Yasuda has been studying this subject since 1928 and has recently published a general account of his experiments (Mem. Fac. Sci. and Agric., Taihoku Imperial University, 27, No. 1 : Dec. 1939). Ovaries of egg plants gave fruit with Petunia pollen but the reciprocal cross is without effect ; similarly tomatoes arose from action of the pollen of the egg plant but the reciprocal cross would not work. Various combinations were thus tested, and successful combinations for parthenocarpic fruits showed no connexion with the systematic position of the plants. It was shown that if pollen could germinate and the tubes penetrate deeply into the style, parthenocarpy resulted. The growth of the pollen tubes seems influenced by a special substance in the style ; this substance is produced originally in the ovary, a point checked by ingenious experiments with grafted styles. Where the pollen tube can influence ovary development the effect is produced before the tube reaches the ovary ; it is only necessary that the tube should penetrate deeply into the style. Ovaries can grow into seedless fruit if injected with extracts of suitable pollen grains. Pollen grains of the proper species, too old to fertilize ovules and give seeds, may still contain this fruit-producing stimulus and may thus induce seedless fruit production. (*Nature*, 145 : No. 3682, 826—827).

Beetles as Bone Cleaners. An army of beetles has been mustered into the service of cleaning bones of small animals that are to be mounted because the beetles do the job better and quicker than humans. Skeletons and skulls of animals are shipped to the American Museum of Natural History from points as far distant as Persia and Australia and invariably there are scraps of dried meat clinging to them, which must be removed before mounting. The collection of bones is placed in a metal-lined "arena", where they are attacked by hundreds of beetle cleaners. The insects are of a variety propagated from stock received from Africa and Asia. (*Science and Culture* 6 : 204).

Scholarships for Agriculture. The London *Times* announces that Lord Perry, Chairman of the Ford Motor Company, with the approval of the British Ministry of Agriculture, the Henry Ford Institute of Agricultural Engineering, at Boreham, near Chelmsford, is offering 40 free scholarships for the training of British boys for careers in agriculture. The scholarships comprise 10 that are tenable for three years, 10 for two years and 20 for one year. Each is valued approximately at £ 175 a year which includes cost of tuition; board and residence during terms at Boreham House, near the Fordson estates; laundry; pocket money during terms and holidays, specal clothing and boots. The cost, estimated at £ 7,000 a year, is to

be defrayed by Henry Ford. The intention is to provide theoretical and practical instruction in the latest methods of every branch of farming, with classroom tuition and field work in alternate months, in order to train the boys to become key men in British agriculture. The estates attached to the institute cover 4,000 acres, and are devoted to corn crops, intensive market gardening, glasshouse culture, a fruit section with gas storage and the care of 2,000 pigs, 700 sheep and 200 dairy cattle. Applicants for scholarships will be required to attend the institute for a probationary period of one month, during which the final selections will be made of the prospective recipients. *(Science, 92: 147).*

Crop and Trade Reports.

Sugarcane—1940—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory and the yield is expected to be normal in all districts. The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 4th November 1940 was Rs. 5—3—0 in Erode, Rs 5—2—0 in Mangalore, Rs. 4—10—0 in Rajahmundry and Cuddalore, Rs 4—5—0 in Vizagapatam, Rs. 4—2—0 in Adoni and Chittoor, Rs. 3—15—0 in Cocanada and Salem, Rs. 3—14—0 in Vizianagaram and Vellore Rs. 2—15—0 in Bellary and Rs. 2—6—0 in Coimbatore. When compared with the prices published in the last report, i. e., those which prevailed on 7th October 1940, these prices reveal a rise of approximately five per cent in Vizagapatam, four per cent in Erode and three per cent in Rajahmundry and a fall of approximately seven per cent in Salem, five per cent in Cocanada, four per cent in Chittoor and Trichinopoly, three per cent in Coimbatore and one per cent in Cuddalore, the prices remaining stationary in Vizianagaram, Adoni, Bellary, Vellore and Mangalore. *(From the Director of Industries and Commerce).*

Cotton—1940-41—Intermediate monthly report. In the central districts and the South, the sowings of cotton are still in progress in parts. In parts of the Tinnevelly district, the early sown rainfed crop was attacked by surface weevils and resowing had to be done. The area under the crop in the Central districts and the South is expected to be normal or slightly above normal. In the Deccan, the sowings of *hingari* or late cotton have concluded and the area is expected to be normal outside Anantapur where it is expected to be below normal. The crop is progressing well. Pickings of the *mungari* or early sown cotton have commenced in parts of the districts of Bellary and Anantapur. The yield is expected to be below normal. The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per Imperial maund of 82 2/7 lbs as reported from important markets on 4th November 1940 was Rs. 15—10—0 for Cocanadas, Rs. 17—6—0 for white Northerns, Rs. 18—2—0 for red Northerns, Rs. 14—15—0 for Westerns (mungari), Rs. 18—14—0 for Westerns (jowari), Rs. 29—5—0 for Coimbatore Cambodia, Rs. 23—11—0 for Southern Cambodia, Rs. 28—8—0 for Coimbatore Karunganni, Rs. 23—2—0 for Tinnevelly Karunganni, Rs 22—1—0 for Tinnevellies and Rs. 22—13—0 for Nadam cotton. When compared with the prices published in the last report, i. e. those which prevailed on 30th September 1940, the prices reveal a rise of about six per cent in the case of Westerns *(jowari)* and Coimbatore Karunganni, five per cent in the case of Westerns *(mungari)*, two per cent in the case of Nadam cotton and one per cent in the case of Coimbatore Cambodia, the prices remaining stationary in the case of Cocanadas and Northerns (red and white varieties). *(From the Dirctor of Industries and Commerce).*

Groundnut-1940-Intermediate condition report. The winter crop of groundnut has been affected to some extent by heavy rains and floods in Kistna, by drought in Anantapur, Chingleput, South Arcot, Chittoor and North Arcot and by insect pests in Tanjore and Madura. The condition of the crop is generally

satisfactory in the rest of the Province. The wholesale price of groundnut (shelled) per Imperial maund of $82\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 4th November 1940 was Rs. 3—12—0 in Tadpatri, Rs. 3—10—0 in Vizagapatam and Guntur, Rs. 3—9—0 in Hindupur. Rs. 3—8—0 in Vizianagaram and Cuddalore, Rs. 3—7—0 in Nandyal and Vellore. Rs. 3—6—0 in Cuddapah, Rs. 3—5—0 in Coimbatore, Rs. 3—3—0 in Adoni and Bellary and Rs. 3—2—0 in Salem and Guntakal. When compared with the prices published in the last report, i. e., those which prevailed on 7th October 1940, these prices reveal a rise of approximately seven per cent in Tadpatri and four per cent in Coimbatore and a fall of approximately 17 per cent in Salem, 13 per cent in Vizagapatam, ten per cent in Cuddapah and Cuddalore, eight per cent in Nandyal, four per cent in Bellary and two per cent in Adoni, the price remaining stationary in Hindupur. (*From the Director of Industries and Commerce*).

Gingelly—1940-41—Intermediate condition report. The gingelly crop has been affected to some extent by drought in South Arcot, Tanjore and Madura. The yield is expected to be normal outside these districts. The wholesale price of gingelly per imperial maund of $82\frac{2}{7}$ lbs. (equivalent to 3,200 totals) as reported from important markets on 4th November 1940 was Rs. 7—0—0 in Tinnevelly, Rs. 6—9—0 in Trinchinopoly, Rs. 6—7—0 in Cuddalore, Rs. 6—4—0 in Vizianagaram, Rs. 5—15—0 in Ellore, Rs. 5—12—0 in Vizagapatam, Cocanada, and Salem, Rs. 5—11—0 in Rajahmundry and Rs. 5—8—0 in Tuticorin. When compared with the prices published in the last report, i. e., those which prevailed on 7th October 1940, these prices reveal a rise of approximately seven per cent in Vizagapatam, four per cent in Ellore and Tuticorin and a fall of approximately eight per cent in Cocanada, three per cent in Tinnevelly and two per cent in Rajahmundry, the prices remaining stationary at other centres. (*From the Director of Industries and Commerce*).

Paddy—1940-41—Intermediate monthly report. The harvest of first crop paddy has concluded in parts of the Circars, Chingleput, the Central Districts, the South and the West Coast. The yield is expected to be generally normal. In parts of Ramnad, rainfed paddy was affected by surface weevils and re-sowing had to be done. The condition of the crop is reported to be generally satisfactory outside Chingleput and Chittoor. The wholesale price of paddy, second sort, per Imperial maund of $82\frac{2}{7}$ lbs. as reported from important markets on 4th November 1940 was Rs 3—8—0 in Masulipatam and Madura, Rs. 3—7—0 in Rajahmundry and Guntur Rs. 3—6—0 in Cocanada, Ellore and Bezwada, Rs. 3-3-0 in Tinnevelly, Rs. 3—2—0 in Vellore, Trichinopoly and Virudhunagar. Rs 3—0—0 in Vizianagaram, Rs. 2—14—0 in Chittoor, Rs. 2—13—0 in Kumbakonam and Hindupur, Rs. 2—9—0 in Negapatam, Rs 2—6—0 in Cuddalore and Rs. 2—4—0 in Conjeevaram. When compared with the prices published in the last report, i. e., those which prevailed on 7th October 1940, the prices reveal a rise of about 10 per cent in Masulipatam, eight per cent in Bezwada, seven per cent in Kumbakonam, six per cent in Cocanada, Rajahmundry, Ellore, Guntur, Madura and Tinnevelly and two per cent in Hindupur, Trichinopoly and Virudhunagar and a fall of five per cent in Cuddalore, the prices remaining stationary at Vizianagaram, Conjeevaram, Chittoor, Vellore and Nagapatam.

(*From the Director of Industries and Commerce*).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 15th February to 8th November 1940 amounted to 481,296 bales of 400 lb lint as against an estimate of 366,800 bales of the total crop of 1939-40. The receipts in the corresponding period of the previous year were, 449,099 bales. 480,658 bales mainly of pressed cotton were received at spinning mills and 116,378 bales were exported by sea while 119,910 bales were imported by sea mainly from Karachi and Bombay.

(*From the Director of Agriculture, Madras*)

College News and Notes.

Students' Corner. *The Hostel Tatler.* Though late in its appearance, the 'Hostel Tatler' released during the first week of November was given a warm reception. The Editorial Board deserves to be congratulated for producing a thoroughly readable number.

Terminal Examinations. The second terminal examinations are programmed to commence on the 10th December and terminate by the 23rd December.

Games. As in previous years, the inter-collegiate competitions in hockey, cricket, football and athletics among colleges in the Bangalore zone were held at Coimbatore on the Agricultural College grounds. The unusually heavy rains received in the first half of November were responsible for prolonging the stay of the visiting teams at Coimbatore,

Hockey. In hockey the Agricultural College met the Islamiah College, Vaniambadi in the first round and won by 8 goals to nil. The next match was with Voorhee's College, Vellore and proved to be a keenly contested game which ended in a draw. The match had to be replayed three times before the Agricultural College emerged winners by one goal to nil. The third round found us pitted against our local rivals—the Government Arts College, Coimbatore. This again proved to be a keenly contested affair and twice ended in a draw. At long last, we won the match by two goals to nil and became winners in the Bangalore Zone.

Cricket. In cricket we met the Government Arts College, Coimbatore and snatched a convincing victory The College skipper's unbeaten century was the outstanding feature of the match. Our next match which happened to be the zone final was against H. E. H. the Nizam's College, Hyderabad. In this encounter our colours were lowered by a superior team. Hyderabad scored 307 to which we replied with a poor total of 87 runs. The tall score of our opponents is not so much an index of their batting prowess as of serious lapses in our fielding.

Football. We lost our opening match with the Government College, Coimbatore by two goals to nil. The second round found the Government College against Islamiah College, Vaniambadi which ended in a draw but in the replay the former won by one goal to nil. In the third round, the Government College played the Voorhees' College, Vellore. Here again, the first match was a draw, but the Government College won by an odd goal in the replay. In the finals, the Government College met Nizam's College, Hyderabad in a very fast and exciting game which was won by Hyderabad by six goals to three.

Athletics. The St. Joseph's College, Bangalore which did not participate in other competitions were well represented at the Athletic sports. Consistent with their tradition they secured the largest number of points and won the zone championship. Hyderabad was a keen competitor and secured the second place. Our college had to rest content with second places in three events—110 metre hurdles, pole vault and shot-put.

Academic Council. Mr. T. V. Subramania Ayyar, Assistant Entomologist was elected unopposed as a member of the Madras University Academic Council to represent the teaching staff of the College in the seat vacated by Mr. H. Shiva Rao.

Association of Economic Biologists. A meeting of the Association was held on the 8th November at which the following papers were read. (1) Preliminary studies on *Antigastra Catalaunalis* Dup., a pyralid caterpillar pest on gingelly by

M. C. Cherian and Mohammed Basheer and (2) The perennial or tree-castor by C. M. John and U. Narasinga Rao.

Ladies' Club. The annual club day of the Agricultural College Ladies' Club was celebrated on Saturday the 23rd November. This was preceded by a dinner which was held on the 20th. The programme on the 23rd included several items of open sports for women and children and a variety entertainment in which several members and their children participated.

Visitors. Mr. Peri Sundaram, Bar-at-Law a member of the Ceylon delegation to India visited the College and Research Institute during the month.

OBITUARY

The late K. Rajabapaniah :— We deeply regret to record the sad demise of K. Rajabapaniah, B. Sc. Ag. in September last. He was born on 6th June 1912 and entered departmental service on 3rd May 1937. Young in age, full of promise as a specially trained Farm Manager for fruit work in Guntur, it is sad to hear of his death from that fell disease, tuberculosis. We offer heartfelt condolences to the members of the bereaved family.

The late C. Ranganatha Mudaliar :— We record with deep regret the death of Mr. C. Ranganatha Mudaliar on 4—11—40 after a brief illness. He was born in March 1889, and joined the department as artist in 1918. He was an un-ostentatious worker and it is sad that he died in harness after twenty two years of hard service. We offer our sincere condolences to his relatives in their sad bereavement.

Mofussil News & Notes

A small agricultural exhibition was conducted under the auspices of the Local Agricultural Association at Poovanur, one of the centres of work in Mannargudi Taluk on the 20th October 1940 during the *Kumbabishekam* festival of the local temple. The different departmental exhibits, e. g. Aduturai and Coimbatore strains of paddy, green manure seeds, fodder crops, iron ploughs, Settun puddler and pictorial posters etc., were exhibited at the stall. Practical demonstration with the Settun implement in incorporating pungam leaves for *Thaladi* paddy crop was conducted in an area of 70 cents, amidst a gathering of 50 ryots. They evinced keen interest in its working. Abou 750 people visited the exhibition stall. A lecture was delivered on the occasion by the Asst. Agricultural Demonstrator, Mannargudi appealing to the audience for adoption of Departmental improvements on a mass scale.

A. G. N.

Weather Review—OCTOBER 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	4·3	−3·7	71·9
	Calingapatam	3 4	−4·6	45·8
	Vizagapatam	6·0	−1·1	32·0
	Anakapalli*	5·1	−2·8	39·6
	Samalkota*			
	Maruteru*	4·5	−6·2	36·9
	Cocanada	6·0	−1·9	39 7
	Masulipatam	10 3	+2·2	33·7
	Guntur*	2·3	−4 0	29·9
Ceded Dists.	Kurnool	3·8	+0·3	28·9
	Nandyal*	0·0	0·0	0·0
	Hagari*	5·0	+1·3	20·9
	Siruguppa*	6·1	+1·9	23·2
	Bellary	4·6	+0·7	21·5
	Anantapur	13·3	+9·6	24·2
	Rentachintala	3·8		24·3
	Cuddapah	6·4	+1·4	33·9
	Anantharajupet*	6·0	+0 6	25·8
Carnatic	Nellore	8·7	+0·3	27·1
	Madras	6·2	−5 5	24·2
	Palur*	6·1	−3·4	22 8
	Tindivanam*	5·5	−3·5	24·6
	Cuddalore	9·5	−1·5	27 3
Central	Vellore	5·3	−1·0	25·3
	Salem	1·8	−4·9	36·1
	Coimbatore	4·6	−1·8	24·2
	Coimbatore A. C. & R. I.*	2·5	−3 3	17·7
	Trichinopoly	5·5	−1·4	22·7

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	7·9	−2 6	15·1
	Aduthurai*	0·0	0·0	00·0
	Madura	4·0	−3·8	28·7
	Pamban	9·4	+0·4	21·3
	Koilpatti*			
	Palamkottah	4·7	−2·1	15·0
West Coast	Trivandrum	12·0	0·0	58·9
	Cochin	16·9	+3·7	119·2
	Calicut	12·8	+2·6	121·3
	Pattambi*	9·5	−2·3	91·9
	Taliparamba*	8·9	−3 6	141·6
	Kasargode*	6·7	−2·9	140·8
	Nileshwar*	8·5	−0·8	150·6
	Mangalore	11·1	+3·6	141·6
Mysore and Coorg	Chitaldrug	11·4	+7·1	32·3
	Bangalore	2·9	−3·0	29·5
	Mysore	2·8	−3·7	34·5
	Mercara	6·6	−2·1	134·6
Hills	Kodaikanal	9·0	−0·7	48·5
	Coonoor			
	Ootacamund*	5·2	−7·9	39·8
	Nanjanad*	6 4	−0·9	40·4

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

The weather over the peninsula was mainly dry during the first 3 days of the month. Local thunderstorms occurred along the North Madras Coast, South East Madras, Mysore and Malabar on the 4th and 5th instants. On the 7th conditions became unsettled off the coromandel coast but did not develop. Between 6th and 8th thunder storm activity increased in the Peninsula and fairly widespread moderate to heavy rainfall occurred in the east and south of that region, extending to the south Konkan, and south and east Deccan.

On the 10th a disturbance appeared as a depression off the Konkan coast, moving in a northwesterly or northerly direction initially and north eastwards thereafter, it intensified into a severe cyclonic storm and crossed the Konkan coast near Bombay on the 16th and advanced to near Surat. It weakened into a depression and remained stationary there until it disappeared by the 21st. Associated with the movement of the storm, a spell of wet weather prevailed

over the peninsula. Fairly widespread rains were received along the Konkan and Malabar coasts.

On the 19th conditions became unsettled in the central Bay of Bengal and concentrated into a storm on the 20th with its centre near lat. 17° north, long. 87° east. Taking a north-easterly direction the storm passed inland during the night of the 21st and lying over east Bengal as a depression, centred near Dacca next morning, it filled up in the evening. It caused fairly widespread rain along the Orissa coast.

Conditions became unsettled on the south east Arabian sea off the Malabar-coast on the 25th, but became unimportant on the 27th. Widespread thunder showers occurred during the last week in Malabar and local thunder showers in south east Madras and south Konkan.

On the 28th the North East Moonsoon set in over the south of the Peninsula and widespread rain occurred in South East Madras, Mysore and Malabar while local rains fell in Madras, Deccan and along the north Madras coast.

Rainfall was generally in defect except locally in the Ceded districts and Mysore; other climatic elements were not far from normal.

The chief falls of rain reported were:

Calicut	...	7·5″ (10th)
Chitaldrug	...	4·0″ (10th)
Cuddalore	...	3·5″ (31st)
Cochin	...	3·3″ (10th)
Negapatam	...	3·2″ (30th)
Masulipatam	...	3·1″ (8th)
Mangalore	...	3·0″ (15th)

Weather Report for the Agricultural College and Research Institute Observatory.
Report No. 10/40.

Absolute maximum in shade	...	94·0°
Absolute minimum in shade	...	62·8°F
Mean maximum in shade	...	89·1°F
Departure from normal	...	+1·6°F
Mean minimum in shade	...	70·1°F
Departure from normal	...	−0·3°F
Total rainfall for the month	...	2·45 inches.
Departure from normal	...	−3·25 ,,
Heaviest fall in 24 hours	...	0·80 ,,
Total number of rainy days	...	5
Mean daily wind velocity	...	1·42 m. p. h.
Departure from normal	...	−1·41 ,,
Mean humidity at 8 hours	...	73·4%
Departure from normal	...	−6·5%

Summary. There were some premonsoon rains during the month and 2·45 inches of rain were recorded which was below the normal. The sky was moderately clouded and the relative humidity was below the normal. The mean maximum temperature was slightly above the normal while the mean minimum was nearly normal. The wind velocity was below normal.

(P. V. R. & R. S.)

Departmental Notifications.

Gazette Notification.

Appointment.

Sri. P. Krishna Rao, Assistant, Millet Section, in Class I of the Madras Agricultural Subordinate Service, is appointed to act in Category 8, Class I Madras Agricultural Service, as temporary Gazetted Assistant to the Principal, Agricultural College, Coimbatore from the date of taking charge.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. V. V. Rajagopalan	Offg. Assist. in Entomology	A. D., Dharapuram.
„ C. A. Ramalingam Pillai,	A. D., Ambasamudram	A. D., Koilpatti.
„ K. Dorai Raj,	Offg. Asst. in Paddy, Coimbatore.	A. D., Cuddapah.
Janab A. Abdul Samad Sahib	D. F. S., Hagari	Asst. in Paddy, Coimbatore.
Sri. S. Kuppuswami Ayyangar,	A. D., (on leave)	A. D., Tindivanam.
Mr. K. M. Jacob,	A. D., (on leave)	A. D., Wynaad.
Sri. P. Kesavanunni Nambiar,	A, D., Wynaad	F. M., A. R. S., Taliparamba.
„ E. Achuthan Nair,	F. M., A. R. S. Taliparamba	A. D., Harur.
Janab Muhammad Faisuddin Sahib,	F. M., under training, A. R. S., Guntur.	Off. Asst. in Cotton, Coimbatore.
„ Muhammad Zainulabdeen Sahib.	Off. F. M. under training A. R S., Guntur	Temporary Asst. in Cotton, Narasaraopet.
Sri. T. V. Srinivasa Charlu,	A. F. M., A. R. S. Aduthurai.	A. D., Tanjore on relief
„ S. Krishnamurthi Rao,	A. D., Hospet,	A. D., Alur.
„ B. V. Ramana,	A. D., on special duty Sugarcane Growers' Society, Bobbili	A. D., Tuni.

Leave.

Name of officers.	Period of leave.
Dr. C. Narasimha Acharya, Asst. in Chemistry (on foreign service)	Extension of L. a: p. on m. c. for 1 month from 3–11–40.
„ M. P. Kunhikutti, Asst. Marketing Officer, Madras.	L. a. p. for 4 months from 16–9–40.
Sri. L. Krishnan, A. D., Tanjore	L. a. p. for 2 months from 8–11–40.
„ N. C. Tirumalachari, A. D., Srivilliputtur.	L. a. p, for 1 month and 19 days from 5–11–40.

Sri. M. R. Balakrishnan, Asst. in Chemistry A R S, Siruguppa,	Extension of l. a. p. on m. c for 3 months from 17—10—40.
,, S. P. Fernando, A. D. Harur	L. a. p. on m. c. for 3 months from 11—10—40.
,, A. B. Adisesha Reddy, A. D. Alur	L. a p. for 1 month and 20 days from 4—11—40.
,, E. Kunhappa Nambiar, Upper Subordinate (on leave)	Extension of l. a. p. for 1 month and 18 days from 6—11—40.
,, B. M. Padmanaba Ayyar, A. D., Gingee.	Extension of l. a. p. for 1 month from 1—11—40.
,, Bhairy Siva Rao, A. D., Tuni	L. a. p. for 4 months on m. c. from 5-12-40.
,, R. Narasimha Ayyar, A. D., in Mycology.	L. a. p. for 1 month from 15—11—40.
,, L. Sankarakumara Pillai, A. D., Rasipuram.	Extension of l. a. p. on m. c. for 3 months from 4—11—40.
,, T. Dakshinamurthi, A. D. Adoni.	L. a. p. for 1 month from 14—11—40.
,, N. Ranganathachari, A. D., Dhone.	L. a. p. on m. c. for 1 month from 18—11—40.

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EDITORIAL

Madras Debt Relief Act upheld. The validity of the Madras Agriculturists Debt Relief Act was challenged before the Federal Court, New Delhi in the form of an appeal in which it was contended that the Provincial legislation encroached upon a forbidden sphere viz., Negotiable instruments or promissory notes which fall exclusively within the domain of the Central legislature, and as such the inclusion of debts due under negotiable instruments under the Madras Act had rendered the Act wholly or partly invalid. In dismissing the appeal, the court by a majority verdict upheld the Act and declared it valid. The learned judges held that it was inevitable that legislation purporting to deal with subjects in one list may touch those in another list and consequently different provisions of an enactment may be so closely intertwined that a strict verbal interpretation would unjustifiably invalidate several statutes. They therefore felt that as per the rules evolved by the Judicial Committee, the statute should be examined to ascertain its 'pith and substance'. Under this test, the Madras Debt Relief Act was not meant to be a legislation with respect to negotiable instruments or promissory notes and the overlapping of the Provincial Act was only incidental. Moreover the alleged repugnance of the Madras Act to the existing Indian Law was cured by the previous assent of the Governor General and consequently there was no justification to declare the Act wholly or in part inoperative. The judgment of the Federal Court in what may be considered as an important 'test case' is of great consequence to the agricultural community of the province. The possibility of the overthrow of the Madras Act by the highest legal authority of the land spelt disaster on the economy of the small agriculturists who were just beginning to benefit from a piece of wise legislation calculated to salvage them from a condition of age-long indebtedness to the usurious money-lender and the extortionist land-lord. The Act has now passed through several vicissitudes and it is a matter of satisfaction that it has steered clear of another dangerous corner.

India to grow flax. We are glad to note from a recent press announcement that attempts are being made in some parts of India to grow flax. An essential commodity in peace, flax has assumed great importance during the war. Flax fibre forms the foundation of such important materials like seaming twine and high class cordage so essential for the manufacture of

canvas goods, leather goods, tents, tarpaulins, fire-hose etc. which are required for eguipping the army, navy and air force. Though India has no reputation for growing flax as a fibre she happens to grow 4 million acres of the linseed plant (*Linum usitatissimum*) which is botanically the same as the one which yields flax. We are aware that the strains of *Linum* which produce high grade flax are different from those which yield linseed. Yet it sounds strange that in a great continent like India which possesses an astonishing variety of soil and climatic conditions, no serious efforts have been made to study the possibilities of flax culture. In 1938, the world produced 800,000 tons of flax fibre of which the contribution of the British Empire was only 1 per cent while her domestic requirements were ten times as much. The deficit was supplied by important producing countries like the Soviet Union, Poland, Latavia, Lithuania, Estonia, France and Belgium. With the outbreak of the war, these sources were closed to Britain and she had to fall back on the resources of the Empire. The importance of the commodity can be gauged from the fact that last year the British Ministry of Supply sent 400 tons of flax seed to Australia to sow 13,000 acres, the condition being that growers would be paid £5 per ton of flax straw produced.

Flax is reputed to grow luxuriently in moist areas with a mild climate. Being a crop of about $3\frac{1}{2}$ months' duration, it should be possible to find suitable localities in the Madras province which should prove suitable for, flax culture. Even in western countries like Ireland, Russia and Belgium human labour is largely employed for such operations like pulling, rippling, retting, drying, rolling and scutching. For these reasons, the cultivation of the crop and the preparation of the fibre for the market open out great possibilities for the province. We trust that the Government of Madras will launch some experiments to study the possibilities of flax culture in the province.

Land Reclamation Methods—*Sequelae* to Soil Erosion *

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Introduction. In the agricultural countries of the Old World, farming for several centuries has not significantly reduced the productive capacity of the land, because Nature-induced erosion was always kept under control, through *conservation* farming, as opposed to *exploitative* farming which is the primary cause of man-induced erosion. In the words of Sir Daniel Hall, "the methods practised by the pioneers in the development of a new country are rarely those of sound agriculture... ". To capture the international trade in agricultural commodities, all opportunities, as they arose in the last World War, were harnessed and soil fertility was bartered away for the precious metal, as so much produce exported is so much soil fertility driven out of the land. Deforestation, to meet the needs of wood for fuel, cellulose, explosives, newspaper, books, rayon, match sticks, paints, varnishes &c. and to bring more land under the plough, for agricultural produce, brought in its wake, floods, erosion and the desert. Forty million acres were worked in this way, in the U. S. A. (Africa is no better) and were abandoned during the World Economic Depression, from the erosion that resulted through faulty land utilisation, mainly mono-culture. Wild floods are unknown in areas not tampered by man. The cities, railways, roads, hydro-electricity, water supply schemes, irrigation and navigation projects, all secured through forced production converted to astronomical bank balances, are shaken in their very foundations, by erosion induced by man, through deforestation and floods. To quote Jacks and Whyte, "more soil was lost from the world between 1914 and 1934 than in the whole of previous human history." The combined effects of boom, slump and drought produced a catastrophic biological and physical deterioration of whole regions, culminating in dust storms and floods which threatened to become fixed events in the calendar of North America.

The toll of erosion. The uneven surface of the land, the incapacity of the soil to permit of percolation of rainwater as quickly as it is received, the annual uneven distribution of rainfall and the whole of it finishing off in a few downpours are the familiar causes of soil erosion. In the stupendous quantities of soil let down annually, fabulous losses in nitrogen, potash, lime and humus occur, when compared to the normal intake of plant foods, in such soils. The muddy water of rivers, laden with the eroded soil, silts up the spawning beds. Turning into the up-country, the soil originally teeming with life, is rendered lifeless. None can gainsay Nature's decree. Land is never restored to its original state, but is reclaimed to some extent, by some of the methods given below.

* Paper read at the Twenty-ninth College Day and Conference of the M. A. S. U.—July 1940.

Methods of Reclamation. All reclamation methods of eroded land go under four broad groups. They are (i) Mechanical, (ii) Agronomical, (iii) Biological and (iv) Socio-economic.

(i) **Mechanical Methods of Reclamation.** The slow but persistent removal of the final fractions of valuable soil under 'sheet erosion', the wash out with squally violence in 'gully erosion', the dune and desert formations from 'wind erosion' and the engulfing of productive land by 'sea erosion' may all be arrested, by adopting suitable courses of action, individually, communally or regionally, by resorting to minor works such as contour terracing; contour hedging; contour trenching; contour ridging; tilling across the field gradient; damming ravines; throwing embankments across 'dongas'; erecting dikes; arranging 'pockets and spill' ways and providing storm water drains.

Individual. The use of these methods to counter-act erosion, are known to the Indian pesantry, from time immemorial. All agriculture on the slopes of the Ghats have been rendered possible, by a knowledge of the above. In the slack periods the peasantry annually mend the havoc of past denudation and attend to necessary work to prevent future erosion. The thousands of small seed bed tanks and ponds spread over the vast Godavary Western delta are no more than the "pockets and spill ways" that are suggested on the subject to control erosion. Quite apart from the various measures cited above, there is nothing to equal the will of the farmer in averting on his holding, a distant catastrophe of whatever magnitude, by the timely close up of the imps that tend to gnaw the entrails of the soil. The orchards, in the villages of Nandarada and Dosakayalapalle of Rajamundry taluq, are some of the best that deserve mention in this connection, notwithstanding the erosive nature of the light soils on which they are raised.

Communal. In the Godavary Western delta, a number of Joint Stock companies are working in projects like the Losari- Gultlapadu, Vemuladeevi, and Kalipatnam, in reclaiming lands, from a number of evils, of which erosion is one. The soil of these projects rendered into a syrup, by the floods overflowing the embankments of the drains, is transported bodily. In some of the States in America, the Soil Conservation District Laws give scope to farmers to co-operate and undertake demonstration projects, of soil conservancy. 'Badava' lands all along the sea-board, in which paddy and finger-millet are cultivated, are periodically overrun by tidal action. Such lands in the villages of Komaragiri and Neman of East Godavary are protected by bunding against the sea-flow.

Regional. The larger interests of a province, or a country can never be served, by a few joint stock companies. State effort in bunding in Belgaum, Dharwar and Bijapur districts, in contour ridging (Watt-bundi) in the Kangra district and in contour trenching in the Punjab and the U. P., has already achieved substantial results.

What is required for this Province is (1) the conduct of a survey of the areas suffering from erosion and needing reclamation ; (2) long-range planning for taking up and finishing the ameliorative operations, by zones and under stated periods of time ; and (3) the inauguration of a minor engineering department, for tank formation and tank restoration. Erosion, in areas of poor soil binding, is a great menace. In such, the preservation of the catchments to be formed with forest reserves and vegetation, and the rivetment of the bunds to be put up, may never make the works 'productive' in the P. W. D. sense. The tank formation and the tank restoration, in the province, may easily cost several times the estimated cost of the Tungabhadra project ; but the resources of the country will be permanently improved in a manner comparable to the State drive in Italy, where a swampy expanse has been metamorphosed into arable land and the scourge of malaria driven out. The Tennessee Valley in America, would be spending to the tune of nearly 400 million dollars, for the ten years ending 1943, in the reclamation projects of eroded lands. In Japan with the " operation of the natural forces of sedimentation, plant succession and re-vegetation " under the check-dams of the Forest Engineer, erosion is checkmated. Japan and Java, " two islands with highly erosive topography and climate and supporting 500 and 680 people per sq. mile ", have erosion under full control.

(ii) **Agronomical Methods of Reclamation.** The free play of sun, wind and rain on bare soil brings about erosion. It is therefore necessary to have 'plant cover' on the land, at least during periods in which erosion is the greatest.

Sound rotations. The rotations to be practised are to be such as would (1) minimise the periods of fallow, (2) produce crops producing a dense stand and a soil binding root system and (3) provide for recuperative crops that give nitrogen to the soil. Unoccupied cultivable waste, when brought under cultivation is first put under horse gram, which is a leguminous recuperative crop producing good plant cover. Cotton, maize and tobacco, that require to be spaced widely, are generally unsuitable as reclaimers and have to be rotated with those which produce a good plant cover. The experience of Mr. Kanitkar, of the Bombay department, of Agriculture cuoted by Dr MacLagan Gorrie, goes to show that sorghum, which figures prominently, in the rotations of the eroded black soil tracts, is a good controller of erosion. The following typical, age-long, dry-land rotation, of the loams and the clay loams of the Telugu districts, is a protector of the soil and affords plant cover for a great part of the year.

1st year :— **Mixture of dry paddy and red gram ;**
2nd year :— **Chillies with rows of cotton at intervals ;**
3rd year :— **Groundnut followed by coriander ; or Bengal gram, or fodder sorghum, when conditions permit.**

Unfortunately such rotations are not regularly practised by the cultivators who are lured away by money crops like chillies which are raised annually, as at Gollaprole in Godavari district. Mono-culture systems as maize in the

corn-belt and cotton in the Southern States of America, and cotton followed by maize in Uganda are said to be the causes of the disastrous erosion, in those countries.

Green manuring. Sometimes in preventing one evil, we may bring about another. Incessant cropping done with the object of securing a plant cover may bring about soil exhaustion. Secondly, with the onset of the monsoons, heavy masses of soil are rolled down streams, breaching embankments. A number of wild streams between Bezwada and Kovvur play havoc on the country, every year, in their traverse to the Kollair lake. Raising green manure crops is a panacea to these evils. The matted root system, binds the soil and prevents to some degree, this scouring of soil by floods.

Mixed Farming. For a country dependent on cattle for its agriculture, mixed farming provides the cattle with diversified feeds, and conserves the land by warding off erosion. A Telugu proverb condemns the practice of raising of pure crops under rainfed conditions. Run off and erosion figures collected for a number of years at the Missouri Experiment Station, Columbia and the observations of Dr. MacLagan Gorrie in this country, indicate that in the order of their importance bare fallow, sound rotation and pasture aid soil conservancy.

Limit of safe productivity. Under the perennial irrigation system of the deltas, raising two or three crops of paddy, in an year or garden crops which are gross feeders on soil fertility may impoverish the soils.

Site of plots and soil blow. The fragmentation and the disintegration of holdings are a blessing in disguise, in lessening erosion. Plots of half to two acres are found to be fairly free from erosion, in the Bombay Presidency. Such divisions of land are a necessity, in the light soils of Anantapur, where the harvest of groundnut with bullock hoes turn the soil to the fineness of flour and render it liable for wind erosion.

Strip cropping. Strip cropping with arable crops alternating with 'dense sod crops', is now under practice, all the world over, as a conservancy measure.

Selective weeding. This is in vogue in plantation agriculture, for soil conservancy. Obnoxious weeds above are eradicated, while the less harmful are left untouched, in the tea, coffee and rubber estates, in Ceylon and South India.

(iii) Biological Methods of Reclamation.

Regulation of the strength in livestock and controlled grazing. Strangely, the very factors that retard progress in livestock improvement, also assist erosion. Greater destruction of plant cover and heavier indiscriminate trampling arise with the maintenance of a higher proportion of cattle than is justified by the cultivated area. The Vizagapatam district (specially the Vizianagaram taluq) is one of those suffering greatly from soil erosion.

It may be due either to its red loams ; it may also be due to the stock-rearing industry, in that district The trodden paths of cattle and goats assisted by scouring in rainy periods bring about gully erosion. The village commons and the unreserves thrown open to grazing get greatly eroded, through such indiscriminate trampling The pasture grasses grazed bare, fail to recover in time, to be economically useful. Controlled grazing and cutting the grasses periodically sound well toward stock improvement as well as the prevention of soil erosion. But to do away with the over-stocking and un-economic herds in a country that is averse to the destruction of life is no easy matter. Are sufficient areas available even for the indispensible tilling cattle, to arrange for grazing by rotation in blocks, for the permanent preservation of pastures ? In the tracts of intensive cultivation, as well as in wetland areas, it is hardly possible to have standing room for the village cattle, especially during the inclement weather. This has been a thorny subject receiving attention for several decades. Educative propaganda and slow state intervention, with caution, would secure the desired object of getting rid of the un-economic herds, over-stocking, promiscuous grazing and the want of organised pastures.

Regulated forestry. The forest policy should not be pursued as a commercial revenue proposition. Forest preservation and controlled grazing are antagonistic to the world's needs of wood and meat, but all the same they are to be helped in the interests of national economy. The very many uses which wood is now put to, may bring in, a time, when forestry may be encouraged and made to encroach on agricultural land. Submarginal exhausted agricultural land may be re-forested, or brought under controlled grazing, as under the Taylor Grazing Act of 1934, in America.

Ecological engineering and re-vegetation. Ecological observations of the flora and the fauna on the land, as also a study of the habits of the communities settling on the land are necessary to practise ecological engineering, for soil conservation. New fauna (from the domesticated) should not be introduced, if they bring in degeneration of the flora *in situ* Nor should man be permitted to dominate and disturb the balance existing between the land and the flora it is supporting.

Extensive cultivation is going on, in the sandy loams of the coast-wise areas, under *doruvu* wells and along the banks of the rivers Hagari, Pennar &c. that have sand in them and no water flow for a greater part of the year. In both the kinds of tracts, the water bed is fairly high and manure being the only limiting factor of production in them, quite a variety of valuable crops is raised. Unfortunately, the play of strong winds on the coast, as well as in the areas of low rainfall of the said rivers has led to erosion on the wind-ward side and dune formation on the lee-ward side. Wind-breaks and shelter belts in which bare land alternates with crop land are the main ways to deal with. Casurina is widely grown on the coast and to some extent on the afore-mentioned river banks and adjacent to the banks

Shelter belts are greatly used in the Jutland peninsula, of Denmark and are claimed to give protection to areas "equal to ten to twelve times their height". In addition to the moderating influences on soil temperature, wind, humidity and evaporation, high crop yields up to thirty per cent are also reported.

Soil binding may be effected with re-vegetation by suitable ecological material. The trees that are used for the purpose, in the several countries of the world are Acacias, *Cassia siamea*, casurina, Eucalyptus, Festucas, Pines, poplars, spineless cactii and willows.

The following are the vines, creepers and grasses, in vogue for the purpose, in the various countries.

Botanical name.	Common name.	Country of use.	Remarks.
	Vines and Creepers		
Pueraria thumbergiana	Kudzu vine	U. S. A. and S. Rhodesia	Originally a native of China; propagated from roots and crowns
Bignonia radicans	Trumpet creeper	U. S. A.	
Strophostules helvola	Trailing wild bean	do.	
Lespedeza striata	Lespedeza	do.	
Ipomdea biloba	Sand-binding weed.	India	Used by the railways on the permanent way.
	Grasses		
Eruarta villosa	Pyp grass	Africa	
Cyanodon dactylon	Bermuda grass	India	'Hariali', or lawn grass
Agropyron scabrum	Blue grass	New Zealand	
Aristida pennata	Sand grass	Russia	
Eremochloa ophiuroides	Centepede grass		
Pennisetum clandestinum	Kikuyu grass	India, Africa	
Andropogon halepense	Johnson grass	do.	
Faspalum sp.	The kodo millet group	do.	
Agrostis sp.		do.	

Besides possessing the property of soil or sand binding, the material chosen should be drought resistant, rhizomiferous, stoloniferous and of the seeding kind, for rapid establishment. It should as far as possible be unpalatable (e. g, rabbit menace in S Australia and locusts in Kenya), hardy in withstanding soil and sand blow and as far as possible indigenous. Turfs and sods serve the purpose quicker than vegetation through seed propagation.

(iv) Socio-Economic Methods of Reclamation.

Restriction of international trade in soil fertility. The soil is a mine from which fertility is drawn and transported across the seas, in the name of

produce. The high tariff wall built by U. S. A., against the import of agricultural commodities, after the last World War and its non-acceptance of payments of war debts in goods, assisted soil conservation and thus arrested erosion in a measure; though countries solely dependent on agriculture under the falling prices, following the boom had to resort to over-production, to make both ends meet.

The higher the standard of living of the ryots, the greater is the erosion. The impact of western civilisation, on the agricultural populations of the East, raised the standard of living of the latter, during the last three or four decades. The agriculturists of Egypt and India, for centuries adjusted their mode of living to the productive capacity of the soil. Better living enjoins over-production and therefore erosion ultimately. Present rural uplift work should countermand this evil, by necessary propaganda.

Capitalist farmers and industrial magnates. Capitalist farmers emulate industrial magnates, in the possession of wealth and style of living. Agriculture is not organised, in the same way as Industry. Agricultural produce cannot be preserved, nor can it be held over, for years, to regulate prices, as industrial goods. Where the capitalist farmers ape the industrial magnates in the bank balances and style of living, there it is at the expense of the soil, degradation and denudation coming in much quicker in this capitalist farming than under any other system.

The Agricultural Adjustment Act, in America, restricts agricultral production, by the allotment of areas, to the limits of the local and reasonable foreign demand, based on a sound national economy. The co-operation necessary for the working of the Act is secured by compensating for the reduced production.

Agricultural prices to be on a par with the industrial. For an agricultural country like India, agricultural prices must, at least, be set at par with those in Industry, marshalling all the resources of economics, so as to keep the soil fertility intact The soil of the country, the capital legacy of past generations should be handed down to posterity, by the present generation, without consuming any part of its capital.

Society and the Soil. A stable soil keeps a civilisation stable and free from social unrest. The society that settles on the soil should be symbiotic in its nature and its habits, with the farming system the soil is capable of. In this vast agricultural country, each soil type can have its counterpart in society, be it aboriginal, tribal, *ryotwari*, or any other. The Soil Physicist and the Agronomist are the councillors, to determine the type of Federation that is best suited to perpetuate agricultural India.

Imposition of quotas. In the national economy of the country imposition of quotas on cultivation and production may, when necessary, be introduced, to avoid the burning of wheat and the leaving of the cotton crop un-picked. The creation of an economic bureau, for sound economic nationalism, would go a great way, to stem the tide of soil erosion.

Urbanisation promotes soil erosion. As urban prosperity is at the expense of the rural agriculturist, the burden of taxation should be shifted from the country to the town and from Agriculture to industry.

Land tenures. The system of tenures, on which land is held by communities, is responsible in some measure, for soil erosion. Southern Rhodesia has been a victim to it. Russia passed from Feudalism, Communal Field Farming, Capitalism and Collectivism, to Socialism. How far the last survives the earlier systems, on the steppes of Russia is yet to be seen.

The holdings of owner-cultivators are less liable for erosion than those under tenants. With the ease-loving habit of man, the strength of the owner-workers is falling and that of tenants increasing. Short term tenancy is a result of rack-renting and lands under this system are the worst liable for erosion. The systems of tenures that should prevail, between land-lords and tenants, for soil conservancy and doing away with erosion are also subjects for the bureau of economic suggested for creation.

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Tenants' Needs and Departmental Limitations.*

By M. BALAKRISHNAN NAYAR, B. Sc. Ag.,

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Introduction. This paper is based on my study of a few holdings in Malabar with regard to the economics of paddy cultivation. It has been my experience in the course of the investigation, which is being conducted under the auspices of the Madras University, to find the people mostly indifferent and sometimes critical about the doings of the Agricultural Department The causes of such indifference, as I see them, are presented in this article.

General. Earnings in Agriculture may be generally poor but the level is particularly low in the conditions existing in the Malabar district. With no mixed cropping or rotation in crops, paddy is grown in wet lands year after year with the success of the crop depending largely on the south-west and north-east monsoon rains. The cultivation is further complicated by the

* Paper read at the Twenty-ninth College Day and Conference of the M. A. S. U., July 1940.

system of land tenure peculiar to the tract. The ownership of land is vested in a comparatively small section of the people styled *Jenmis*, while cultivation is carried on by a large body of tenants and under-tenants. Rice is the staple food of the people; and the tenants who are mostly small-holders, bear the brunt of food productions.

Needs of the Tenant Farmer. The fields have to be prepared before sowing seed and the tillage operations involve the use of cattle and human labour. Implements have to be assembled and some provision made to meet the recurring expenditure till the maturity and harvest of the paddy crop. Lacking an alternative occupation, the Malabar farmer has taken to the plough and he is faced with the problem of cultivation. The owner generally pays the land revenue and the tenant-farmer need only raise the crop and remit the rent after harvest. The minimum expenditure on cultivation when approximately analysed, has been found as follows :—

Average calculated from 27 holdings examined in Ernad Taluk, Malabar District.

Area under Rice cultivated by one pair of cattle.	Expenditure.		Remarks.
	Item.	Percentage.	
5·4 Acres	Cattle	33·3	
	Implements	4·2	
	Seed	13·2	
	Cultivation expenses	49·3	
	Total	100·0	

These average figures are, of course, misleading because a few big-sized farms exist beside a greater number of smaller ones. As a matter of fact the holdings are much smaller than the average area under paddy as indicated above. If the members of the tenant cultivator's family do all work on the farm, "cultivation expenses" could be considerably reduced. But he must perforce buy his cattle, plough and seed, and to find funds for all this is his main problem.

Nature of Government help Loans are granted to the agriculturists under the Land Improvement Loans Act of 1883 and the Agriculturists' Loans Act, 1884, for the construction of wells and tanks, and for the purchase of seed, grains, work cattle, implements and other agricultural operations. Such help is rendered by the Government through its various departments noted below.

(a) *Revenue.* Distribution of loans to the agriculturist, to help him with his primary requisites such as cattle, seeds, etc., is mainly the work of the Revenue Department. The loans are given on landed or personal security. The tenant-farmer, who is in the main a simple-lease holder for one year, has neither of these to offer. He is not credit-worthy enough to take advantage of such loans.

(b) *Co-operative.* The prosperity of the small holder may lie in the direction of co-operative institutions, but before much good can be expected,

the masses should be better educated in the principles of co-operative effort and more "Raiffiesens" should spring up even in interior villages.

(c) *Industries.* Loans are distributed by the Industries Department for the purchase of oil engines and pumps, but they do not figure prominently in the Malabar tenant farmer's economy.

(d) *Agricultural.* The Department exists for the welfare of the ryots and for improving agriculture by scientific means. But the poor tenant in Malabar cannot derive the full benefits of such improvements unless the departmental help extends beyond mere advice. It does not help him effectively as it has no powers to grant loans for the purchase of cattle, and seed. Loans are, of course, sanctioned by the Agricultural Officers for the purchase of implements, but in Malabar, the small-holder finds himself more at home with his cheap and native tools, which have stood the test of time, rather than with the improved machinery. With many tenants, manuring is a matter of capacity or convenience and few are able to pay the necessary attention to the fertilizing of the paddy fields. Whatever manure is available from his stock is applied to his fields and sometimes supplemented by green leaves and green manuring. With the rice cultivator the Department has established a name and is popular for its pure seeds of strains. But as he looks to the Department for fresh supplies of seed instead of multiplying it on his own farm, he is necessarily disappointed since only a fraction of his needs can be satisfied at present. Thus with limited scope for work among the poor paddy cultivators, the Agricultural Demonstrator in Malabar is constrained to restrict his sphere of activity still further because he is bound by rules to adopt the only procedure of "cash and carry".

Public Opinion. The views and opinions freely expressed by the public could be brought under two categories: (1) the "ill-informed" and (2) the "informed".

(1) *Ill-informed opinion.* The educated section of the public who have generally no interest in land or its cultivation is often guilty of such opinions. Their complaints are not often based on facts and could have been set aside but for the thought that every one of these educated critics, by propagating incorrect views about the Department creates an atmosphere which is not conducive to 'bridge the gulf' that exists between research and the ryot. They should have correct information before levelling their criticisms for then alone will their criticisms have real value. Much of this ill-informed opinion could be corrected if the Director of Agriculture, supported by this House, presses on the Government and the Universities the need to include "The Activities and Achievements of the Government Research Departments" in the text book of our educational institutions. Propaganda and publicity should be intensified on more modern lines and greater information made available to the public regarding the different branches of Agricultural Education and Research.

(2) *Informed opinion.* This should be welcomed by the Department. The Agriculturist expresses such informed opinion with a closer knowledge

of his diffculties which are mostly of a pecuniary nature. And when he finds that its advice has no financial backing, not only the Department but also the whole of Agricultural Research falls low in his estimation. Difficulty in getting money to begin cultivation and delay or absence of effective help in times of need tend to prejudice the agriculturists against the Department. And the incidence of droughts, pests and diseases in crops, should they occur, only aggravates the tendency. Much of his criticism is real. But, in despair, he forgets the scope and limitations of the Agricultural Department. It has, however, yet to be empowered to give him more material help before if could effectively assume the natural role of existing for the 'Sons of the Soil'. The problem is difficult and many aspects will have to be studied, but it should not be an impossible task to find out an arrangement whereby the department is given the responsibility with power for improving the lot of the agriculturists.

An analysis of the situation calls for the following remedial measures.

Granting loans. To win him over and gain his complete confidence may land the Government in much capital investment, but the Agricultural Department could be immediately helped to appear in brighter light if whatever loans are at present distributed by the Government are done by the Agricultural Officers themselves, or through them.

Avoiding delays. There are inevitable delays in administration which the ryots cannot often understand. If he does not get in time his seed remedies or prescriptions for pests and diseases for which he expects spectacular results, he drags the whole Department into the mire without considering the inadequacy of the present staff to cope with the heavy work. But it will be worth while for the Department to simplify its procedure or dispense with certain formalities to cater better to the needs of the farmer.

Affording Irrigation facilities. It might appear strange that in Malabar, crops fail for lack of water. But as they are entirely dependent on rainfall, the cultivation can only be "a gamble with the rain." The contour of the country is irregular, the rainfall unevenly distributed. Difficient precipitation, especially in the months of October and November, reduce the outturn of paddy considerably. It is poor consolation then that the average annual rainfall for the tract is 118 inches, nearly $2\frac{1}{2}$ times the average for the province. The starting of many minor irrigation works requires investigation and the agricultural officer should take an effective part in initiating such schemes.

Faith in Research. What has been said so far is only to indicate some probable ways of restoring the ryots' confidence in the Agricultural Department. It has been assumed that the agricultural research workers themselves have infinite faith in research and in the potential utility of their methods, for, without faith in themselves and in the work they do, they cannot hope to persuade others to take them seriously. The research

workers should also realise their responsibility as joint investors with the agriculturists and the administrators in national progress. They should be ever mindful of the fact that the ultimate test of their labours is in the fields of the farmer; success there is their reward; failure, their incentive.

Conclusion. I shall close my paper with an appeal that this Conference now and in all its future deliberations, may discuss this subject in all its aspects and reflect the hopes and fears, the needs and necessities of the man behind the plough. It should evolve ways and means of bringing the ryot and the research worker nearer. It is my hope that the College Day and Conference of the Madras Agricultural Students' Union, will form the Central Observatory, where once a year rural observations and their bearing on the trials and triumphs of Research will be recorded.

Preliminary Observations on the Insect-free Storage of Grains.

By T. V. SUBRAMANIAM, B. A.,

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Introduction. The successful storage of his grains free from insects is a serious problem for the ryot. The grains have to be stored for some time, longer or shorter, before a ryot can dispose them off for food or for seed and during this period they are liable to be spoiled in various ways; their suitability for food may deteriorate or they may suffer in their germinating capacity; and insects contribute largely to this damage, the loss from which may amount to several lakhs of rupees in a year. It has been calculated that *cholam* (sorghum) grains alone are liable to damage upto 25 per cent during the course of storage for a year; in very bad cases it may be more. According to the Season and Crop Report for the year 1938—39 published by the Madras Government 1,265,300 tons of cholam were produced in this Presidency in that year, valued at Rs. 94,867,500. At a low estimate of 10 per cent the loss due to insects would come to 9½ millions of rupees. This loss has been calculated to be caused by only one species of insect - the rice weevil. If we take into consideration also other insects that take their toll, we can easily imagine, how great the loss caused to *cholam* grains in our presidency would be due to insects. Insects attacking grains are many; this paper deals with observations regarding only two of these, viz, the rice weevil on *cholam* and the paddy-borer beetle on paddy. The rice weevil, though commonly so called, is more a serious pest of *cholam* grains here than of paddy.

Methods of Storage of Grains in this Presidency. Paddy and *cholam* grains are stored in different ways in various parts of the presidency. (1) In some places they are stored openly in the pials of cattlesheds and dwelling houses, rarely covered over with a loose layer of straw; in many cases they are neither cleaned well nor dried before they are stored, so that the facilities for insect infestation are plenty; such simple methods of

storage are common in parts of Trichinopoly and Pudukotah. (2) In parts of Malabar, Pudukotah and Trichinopoly, grains are stored in closed earthen masonry or wooden granaries inside houses after they are well dried in the sun. These granaries do not generally admit of the entrance of insect pests and being more or less air-tight they afford facilities for the fumigation of the grains if and when they get infested. Some of the wooden granaries in Pudukotah are ideal in this respect because they are divided into a number of independent compartments, well raised from the ground and provided with trap doors at the bottom through which the grains can be removed. (3) In the Trichinopoly District, Madura and parts of Coimbatore there is a system of storing grains in open rooms in houses after the grains are well dried in the sun; this system gives free scope for the entry of insects. In some cases the ryots put leaves of Pungam (*Pongamia glabra)* or Neem (*Aziderocta indica*) over the grains in the belief that these prevent insect attack. (4) In certain parts of Coimbatore *cholam* is stored in underground pits inside houses or in the open in the yard or on the roadside. There are two kinds of underground pits. One consists of large masonry cellars 8–10 feet square at the base and 15–20 feet deep with a small rectangular opening about 2 feet square at the top covered over by wooden planks or stone slabs and plastered over flush to the ground level with clay. This type keeps the grains free from insects and grains stored in this manner for over two years have been found to be absolutely free from insects. The other type consists of round pits of uniform diameter dug in the ground: they are generally smaller than the previous type, being only 5 or 6 feet deep and 2—3 feet in diameter; these pits are lined on all the sides top and the bottom, by cholam stubble and old gunny bags, evidently to prevent the grains from coming in contact with the earth. Any space left over the level of grains is filled with earth and every time the grains are removed from these pits, more earth is put in to fill the pit completely leaving no empty space above the grains. This system of storage does not seem to have any value in preventing insect attack as grains stored like this for over 6 months were found badly infested with beetles. The grains stored in both these kinds of pits are said to lose their germinating capacity completely and therefore, they are useful only for food. Moreover, this kind of storage is said to be suitable only for *cholam*. During the storage much heat is produced inside the pit and the air trapped inside becomes suffocating so that grains from these pits could be removed only 12 hours or more after the pit is opened. (5) In the east coast districts grains are stored in round granaries known as *Kudirs* erected inside or outside houses; in the latter case they are provided with thatched roofs. The sides are made of twisted straw plastered over with clay. Some of them are made of several circular rings of straw piled one over the other and plastered together. They have an opening at the top which is closed and plastered with mud after the grains have been put in. Some of these are provided with a hole at the bottom which is kept plugged and through which the grain can be drawn out. Being practically air-tight these are expected to be insect-proof;

but they do not appear to be so in fact. Many of these were found to harbour insects which infested the grains stored in them. (6) In the Ceded Districts, South Kanara, Northern Circars and other places grains are stored in *Mooras, Mudikattus* or *Puries* which are only packages made of twisted straw and sometimes plastered over with mud. (7) Storing grains in big bamboo baskets smeared with cowdung on the outside is common in certain parts of Malabar. The prevention of insect infestation is very remote in this case. (8) Mud pots with their mouth covered and the covering plastered over with mud and tins with tight-fitting lids are commonly used for storing grains especially where the quantity is small; in these cases, of course, insect infestation is prevented to some extent. (9) A common method of storage of grains is in gunny bags in go-downs and here insects usually have free access to the grain.

These are some of the common methods of storage of grains obtaining in this presidency. It will be seen that our ryots do not seem to have attempted much in the direction of prevention of insect infestation in the grains except in such cases where a few leaves of *neem* or *pungam* were scattered over the stored loose grains with the idea of keeping off insects. It is interesting to note that in certain localities the presence of the paddy moth in the grains in storage is considered to be auspicious as it is believed that such granaries would not get empty.

The Problem of Storage. The problem of storage of grains can be approached in two ways: either by preventing the entry of insects that may be in the grains before they are taken into the granary or by tackling the insects in the store; of course the former is easier and more efficient. Some of the insects that attack grains in the store start their activity when the grains are in the field and are carried into the granary along with the harvested grains. These can be prevented from entering the granary by thoroughly drying the grains in the sun and cleaning them well before storage or by fumigating the grains, i. e., subjecting the grains held in air-tight chambers to the action of certain poisonous gases. In either case the insects in the grains are killed to a great extent. Fumigation is a laborious process requiring great care and technical skill, entailing the use of extremely poisonous and often inflammable material; moreover, it requires special facilities for making the granary airtight, so that under the existing conditions in the average Indian village, it will not be possible for the ryot to undertake it. He has, therefore, only one alternative viz. to prevent insect entry and that is thorough cleaning and drying of the grains before storage. This will also be useful in keeping down the number of insects in the store as many species are unable to thrive in whole and dry grains while others require a certain amount of moisture in the grains for completing their life cycle. The weevil is indifferent to oxygen supply so that airtight storage does not prevent the insect from normal development. According to Dr. Cole "A non-ventilated atmosphere at about 80°F. charged with water vapour (no matter how poor in oxygen and contaminated with carbon-di-oxide)

provides most favourable conditions for the life and reproduction of the weevil."

Insects can also be checked from multiplying in the store or even from entering the store by mixing with the grains substances distasteful to them. Some work is being done with this end in view. Experiments were conducted to test the efficacy of various substances which suggested themselves as possible protective agents against insect damage to stored grain. As far as possible only those materials that are used by the ryot or are easily available to him or have a reputation for keeping off insects were selected. Paddy and cholam grains were stored in gunny bags, as is generally done by the ryots and kept in the central farm stores, allowing free access to insects. The following treatments were under trial :— (a) Leaves of *Pungam* (*Pongamia glabra*), *Tulsi* (*Ocimum sanctum*), and *Neem* (*Aziderácta indica*) dried in the shade and mixed with the grains before storage at the rate of 5 pounds per bag ; (b) Powdered Acorus (Tamil-*Vasambu*), Derris, Pyrethrum, and lime to which a small quantity of creosote has been added, mixed with the grains at the rate of 2 pounds per bag ; (c) Jeypore talc powder—a cheap substance which the manufacturers claim to be very effective in protecting grains from insects (as much as would be necessary for a thorough coating ; it took 2½ pounds for a bag of grain) ; (d) a thorough drying of the grains in the sun for a day once a month. One bag of grain was kept as a control without any treatment. Every month one Madras measure of the grains was taken at random from each bag and counts of the population of the insects—rice weevil (*Calandra oryzoiae*) in cholam and paddy borer beetle (*Rhizopertha dominica*) in paddy were taken.

Loss of weight of grain and number of beetles collected in each lot of 200 lbs. in one year.

Treatments.	Cholam. Loss in weight.	Cholam. No. of calandra beetles.	Paddy. Loss in weight.	Paddy. No. of calandra beetles.
1. Control	43·2 lbs.	66135	12 lb.	10717
2. Monthly drying	23·8 ,,	11048	11·6 ,,	2400
3. *Pungam*	36·6 ,,	36580	14 ,,	7086
4. Derris	35·6 ,,	53861	11·6 ,,	2077
5. Paracide	30·4 ,,	34404	10·8 ,,	5758
6. *Tulsi*	46·8 ,,	41508	31·2 ,,	7841
7. Acorus	21·2 ,,	48792	8 ,,	2287
8. Lime and creosote	16·2 ,,	39904	8 ,,	4170
9. Talc powder	164·2 ,,	32970	13·2 ,,	13221
10. Pyrethrum	65 ,,	39901	9·2 ,,	8151
11. *Neem*	44·4 ,,	56990	34·8 ,,	7870

The above table which depicts the results of one year of experiments shows that in general *cholam* suffers more from damage by insects than paddy and that in the case of *cholam* and paddy periodical drying of the grains once a month keeps the insect population very low, that *pungam* and *neem* leaves generally used by the ryots do not give as much protection as is

claimed for them and talc powder has totally failed to give any protection at all—as a matter of fact the number of insects and the percentage of damage in this lot was the highest; the substance seems to have a further disadvantage of damaging the gunny bags in which the grains are stored; the gunny bags had to be renewed more than once during the course of the experiment. Acorus powder and lime with creosote have given very encouraging results. These and other methods of storage are being tried again for another year.

Co-operation in Agriculture with special reference to sugarcane crop in Coimbatore District.*

By P. V. KRISHNA AYYAR, M. A.

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That Agriculture is the mainstay of the vast majority of the population in this country and that the prosperity of the country depends on the condition of agriculture and those engaged in it, are obvious facts which do not call for elaborate arguments to convince anyone. In a world of large scale business, the agriculturists are in need of organisation, and co-operation offers the most ideal form of organisation for them. Co-peration has worked wonders for agriculturists in countries like Denmark, Ireland, Canada and the United States. In India, till recently, co-operation among agriculturists confined itself to one aspect of the problem namely credit. Such a one-sided development had consequences which made themselves felt seriously in the great Depression which set in from 1930. Now it is recognised on all hands, that the rural problem, if it is to be tackled properly, should be tackled on all its fronts. Any attempt to improve the economic condition of the agriculturists must therefore include in its scope finance for production purposes, supply of requirements and marketing of produce.

On account of the circumstances of its origin and early history, the co-operative movement is still largely a credit movement but the lesson taught by the depression referred to above has had its effect and societies other than credit are being started in large numbers. Taking the position in the districts of Coimbatore and Nilgiris, there were on 30th June 1940, 725 societies in the former and 96 in the latter. Of these 586 and 72 respectively are credit societies while the rest are for other purposes.

The following classification is intended to give an idea of the nature of work done by the different types of existing societies.

No of societies classified.	Coimbatore district.	Nilgiris district.
1. Land Mortgage Bank	11	1
2. Central Bank	1	—
3. Supervising Unions	16	2
4. Audit Union	1	—
5. Language Federation	1	—

* Paper read at the Twenty-fifth College Day and Conference of the Madras Agricultural Students' Union, July 40.

6.	Loan and sale and Marketing societies	6	1
7.	Building societies	13	2
8.	Stores – general	4	5
9.	do. for mill hands	9	—
10.	Students stores	6	2
11.	Urban Banks and other limited liability credit societies other than salary earners	17	4
12.	do. do. for salary earners	14	6
13.	Agricultural Primary Credit societies.	586	72
14.	Miscellaneous	40	1
	Total.	725	96

The best results have been achieved only by societies in the working of which both the Co-operative and Agricultural departments took joint interest. The aim of both the departments being the same, viz , increasing the income of the agriculturists, coordination of their activities is absolutely necessary and that such coordination yields the maximum results, has been proved by the limited experience gained so far. The Co-operative Societies gain immensely by making use of the results of years of patient research and labour put forth by the Agricultural department and that department has in the co-operative societies an organisation that enables it to propagate the results of its studies to a larger clientele in much quicker time and in a more efficient manner An outstanding instance of such success is the Tiruppur Cotton Sale Society. What it has done for cotton, similar organisations are trying to do for potatoes in the Nilgiri hills and for groundnut, turmeric and sugarcane in Coimbatore district. The seed distribution schemes for potatoes and groundnut which the Agricultural department have taken on hand are sure to be of great help to the societies.

Taking sugarcane, one of the most important money crops, and in the improvement of which Rao Bahadur T. S. Venkataraman, the Sugarcane Expert, has achieved striking results, it is admitted on all hands that, on account of fluctuations in the price of jaggery, the sugarcane grower is often in a precarious position. From the year 1937 with the help of Government of India grants, attempts have been made in all sugarcane growing areas in the presidency to organise the growers on co-operative lines and to secure for them a greater yield and a better price for the yields. The Government of India has set apart a portion of the excise duty levied on sugar for distribution among provinces where white sugar is produced for purposes of assisting of the organisation and operation of co-operative societies among sugarcane growers so as to help them in securing fair prices and for other purposes directed to the same end. The Madras scheme covers a period of 5 years from the date of adoption and it is administered by the Registrar of Co-operative Societies, Madras, who will spend the grant through co-operative societies or unions of co-operative societies of sugarcane growers in factory areas. The Director of Agriculture will give the necessary technical advice to stimulate the cultivation of sugarcane. The scheme is meant

to help the unions and societies to do their work efficiently with the help of the Demonstrators and Inspectors of the Co-operative Department.

The objects of the Societies and the Unions are—

(1) to introduce and grow varieties of cane best suited to the locality and factory;

(2) to introduce early and late maturing varieties to feed the factory and to enable it to crush cane for as long a period as possible.

(3) to maintain a supply of vigorous seed material by adopting "short crop" method in different varieties found suitable to the locality.

(4) to adopt measures to protect the cane crop from insect pests and diseases.

(5) to take such measures as are recommended for improvement in the methods and for reduction in the cost of cultivation such as interculturing, manuring and irrigation.

(6) to concert measures to improve means of transporting canes to factories.

(7) to give facilities for the ryots to check weighment of cane at the factory and avoid delay in the disposal of cane etc.

and (8) to take measures to finance cane growers through co-operative societies at the right time for the purchase of seed, manure, etc. and for harvesting the crop.

In the Coimbatore Sugarcane Growers' Co-operative Union, Ltd. formed and registered under Madras Co-operative Societies Act VI of 1932, there is, an organisation to help the cultivation of sugarcane. The Union has started work in January 1936. The Government have been pleased to place the services of an Agricultural Demonstrator and a Maistry, besides a subsidy of Rs. 1,000 towards purchase of implements, sugarcane setts and manure. So far 252 members have joined the union and subscribed Rs. 8,890 by way of share capital. The Union has introduced high yielding varieties of sugarcane namely Co. 413, Co. 419 and Co. 421 recommended by the Agricultural Department. It purchased 40,000 setts of Co. 419 and Co. 421 from the Tudiyalur village and supplied them to members in Thoppampatti and Jangamanaickenpalayam villages. The Union had also supplied to the members suitable manures worth about Rs. 6,000. It has financed the members to the extent of Rs. 22,434 for meeting their cultivation expenses. Ploughs, cultivators, bund-formers and other implements have been purchased by the union from the Government subsidy of Rs. 1,000 and were placed at the disposal of the members of whom as many as 50 have utilised them to their best advantage.

With the introduction by the Agricultural Department of high yielding varieties of canes like Co. 419 and Co. 421 and using proper manure, there has been a marked increase in the average yield per acre followed by an extensive cultivation of sugarcane crop especially within the last 3 years. The area under sugarcane cultivation has almost doubled, resulting in overproduction. This and other reasons have led to a fall in the price of

jaggery. The average yield of jaggery has also increased from 30 to 35 pothies (one *pothy* = 280 lb.) per acre. There has not been a corresponding demand for it. Even the little export from Coimbatore of lump jaggery to Bombay, Sholapur, Hyderabad and Calcutta has decreased of late. By selling jaggery at Rs. 6 per *pothy*, barring incidental expenses, the ryot can, hope to get only a margin of Rs. 3 per *pothy*. If the cultivation is extended the cane cultivator stands to lose heavily.

By way of a complement to the activities of the Sugarcane Growers' Union, with a view to give a greater income to its members and other sugarcane growers it is proposed to organise a sugar factory on co-operative basis, to convert the surplus sugarcane into white sugar. Fifty per cent of the canes grown in this district will be consumed at the factory for conversion into sugar.

Calculated on a modest basis, the ryots will get an extra return of about Rs. 6 lakhs every year even if the price of sugar goes down to Rs. 27—8—0 per bag of 2 cwts. It will be gratifying to note that this will also yield to the Central Government an excise duty of about [illegible] lakhs.

The necessary finance for running a sugar factory on a large scale has to be raised by way of share capital and loans from the Coimbatore District Urban Bank. The Coimbatore Sugarcane Growers' Co-operative Union has enthusiastically come forward to work up the scheme proposed. The proposal for the establishment of a Co-operative sugar factory in which the cane growers will be enrolled as members, was taken up at a meeting of the Board of Directors of the Union and important cane growers. The Registrar of Co-operative Societies, Madras, The President of the District Urban Bank and the Deputy Registrar of Co-operative Societies were present at the meeting. The proposal of establishing a sugar factory was discussed in full and the following decisions were arrived at.

(1) That a Co-operative sugar factory consisting of cane growers should be started.

(2) That ryots should take up 3000 shares of Rs. 250 each.

(3) The share amount may be paid in full in cash. In the alternative a share holder may pay Rs. 100 in cash, furnishing a security of unencumbered immovable property for the balance of Rs. 150.

(4) that every ryot should undertake to cultivate and supply to the factory for each share held by him, canes grown over an acre of land for being crushed in the factory.

(5) When 1500 shares have been subscribed for, by the ryots, a separate society will be registered to run the factory. So far 850 shares have been subscribed and earnest attempts are being made to reach the goal.

The starting of this sugar factory will be the signal for launching other schemes to help sugar-cane growers in other areas. It is under contemplation to start co-operative societies for sugarcane growers at Unjalur and Udumalpet to ensure steady supply of canes to the factory from the feeder

societies. The issue of loans on produce, and the marketing thereof will be left with the Sugarcane Growers' Union, to which these societies will be affiliated in due course.

The necessary finance for the enterprise is to be derived from the shareholders and the financing bank, but the co-operation of the Department of Agriculture and Industries are essential for launching the scheme and working it successfully. Sugar factories in S. India are few in number and those, excepting one, are joint stock concerns. The example of the Vuyyur Co-operative factory has demonstrated the possibilities of a Co-operative factory even under difficult circumstances: With much more favourable conditions, a co-operative sugar factory in Coimbatore is bound to thrive well.

ABSTRACTS

The application of genetics to plant breeding. J. B. Hutchinson *Jou. Gen.* **40. 271.**

There can be no response to selection unless the material is genetically variable. The relation of variability to rate of change under selection and the effect of selection in reducing variability are therefore fundamental factors in breeding theory. The examination of unselected crop populations has provided information on the equilibrium between selection and variability that is established in nature and it appears that variability persists at a high level. It follows that natural selection does not naturally result in uniformity and the stability of such mixtures must be due to selection and not to genetic uniformity.

The records of breeding projects with sea Island cotton show that it is in practice impossible to achieve genetic uniformity, even when it is deliberately sought. Variance may be greatly reduced, but it persists in some measure even in the most closely bred strains. If the stability of unselected populations is due to selection and not to genetic uniformity the breeder may regard purity as a secondary consideration. and a new approach to his problem is possible.

The problems involved in the choice of material for selection have been better studied than most others that face the breeder. For most crops the areas of high variability are known. Now that it is recognised that hybridisation is only a means of increasing variability and is a preliminary to selection and not a substitute for it, breeding programmes are better planned No one nowadays wastes his time creating variability when it exists in his neighbour's fields. Where hybridisation is necessary genetic investigations have marked off the dangerous areas where cytological abnormalities and inter-specific breakdown require special treatment, and in some cases, as in cotton sound guidance can be given and the order of its magnitude likely to be found in hybrids of any given type.

Studies of the rate and magnitude of change that can be induced by selection have an obvious bearing on breeding policy, but little information is available beyond Students' analysis of Winter's selection experiments, Harland's account of the Mount Serrat Sea Island cotton and Hutchinson and Kubersingh's analysis of the effect of selection on Malvi cotton A preliminary enquiry into another aspect of the problem of the mass action of genes is Anderson's recent calculation of the limiting effect of linkage on gene assortment in distant hybrids. This has an interesting bearing on the rate of re-establishment of the species balance in Harlands' back crossing method of exploiting interspecific hybrids. S. V. P.

Genes: Atoms of Heredity B. P. Pal. *Indian Farming* 1:6. The degree to which individuals resemble their parents is spoken of as "heredity" and the degree to which they differ is said to be due to variation in this heredity. How these resemblances are perpetuated from parent to progeny and how new differeces arise are the subject matter of the comparatively recent science of genetics.

Within the nucleus there are a number of more or less rod shaped bodies called chromosomes. The number of chromosomes is the same in every nucleus of any one plant or animal and is also constant for each race or species. Thus tomato has 24 gram 16 and man 48 chromosomes.

Furthermore, in these cases the chromosome complement is composed of two similar sets, each chromosome being represented twice in each cell. The chromosomes contain a large number of living particles known as the genes which control the development of all the inherited characters of an organism.

Unlike the division of the nucleus in the body cells where each chromosome divides longitudinally and gives rise to daughter cells with the same number of chromosomes as the parent cell, the nucleus undergoes a different division, in the reproductive cells. In these special cells, the similar chromosomes come together in pairs and separate out to daughter cells without undergoing a longitudinal division, so that after each division each cell contains only half the number of chromosomes as the parent cell. In the act of fertilization the original double number of chromosomes is restored and further divisions of fertilised egg results in cells containing the original double number of chromosomes.

Life is perpetuated by the passage of living material from parent to offspring and this living material is the nucleus with its chromosomes carrying the genes which are the units of heredity.

The genes are extraordinarily stable and pass from one generation to another unchanged. Occasionally, however, changes do occur in individual genes producing visible effects on the organisms. These changes are called "mutations" and are perpetuated in succeeding generations.

Instead of two sets of chromosomes usually present in any organism of a species, three or more sets are sometimes present. This condition known as "polyploids" is daily common in nature, The polyploids in nature are usually giants adapted to many adverse conditions of growth.

In some instances all the chromosomes of a set are not duplicated but only one or more are present as extras. This kind of change which occurs in nature is termed 'heteroploidy" and may be responsible for evolutionary changes.

Mutations, polyploidy, and heteroploidy are being artificially speeded up by applications of X-rays, temperature and chemicals to plants with a view to getting germinal variations which may eventually prove of economic value.

It has been recently discovered in America that a substance "colchicine" when applied in weak solutions to growing plant cells produces polyploids.

EXTRACTS

Pyrethrum cultivation in Kashmir. Pyrethrum constitutes a genus of Chrysanthemum in Compositae family and is said to constitute a hundred species, out of which some are toxic to insects. The principal species, commercially important is *Pyrethrum cinerarioefolium.* The plant ordinarily resembles the field daisy, particularly the flower which is apparently similar to the daisy, in size, shape and colour. The plant is perennial and grows 18 to 20 inches high.

The dried crushed flowers have a pleasant, characteristic odour due to the presence of essential oil which is pronounced in the freshly prepared material. It has acrid, bitter taste and causes numbing sensation to the tongue and lips which is due to the active principle present in the plant. The active principle is called pyrethrin, which is said to exist in two forms. Both these forms are mineral oil soluble.

The use of pyrethrum flowers in powdered forms and its extraction is known since earlier days. At present very large quantities of the flowers are utilised in U. S. A. and other occidental countries.

The plant is cultivated on a commercial scale in Dalmatia (Yugoslavia), Japan, Kenya, some parts of Italy, United Kingdom and Russia. Japan and Kenya are the two principal producing countries.

Since last several years the use of this insecticide has been found practicable as a control against mosquitoes The adults readily succumb when the pyrethrum extract is sprayed on them, as is evident by the so-called commercial 'Flit". Flit is mineral oil extract of pyrethrum.

India has been importing flowers from Kenya in considerable quantities.

The Imperial Council of Agricultural Research having recognised the possibilities of its local demand, took necessary steps for the introduction of pyrethrum cultivation in India. Seeds in small quantities were imported and distributed to various provinces and the constituent States in the year 1937.

The Department of Agriculture (Kashmir) started its cultivation under the auspices of the Imperial Council of Agricultural Research. This is the third year of the plantation. From the present harvest which has been just completed we have more than half a maund of seed, besides some quantity of dried flowers for experimentation. The last two years' experiments have shown:—

1. Seeds sown in well-prepared nursery beds in spring, early summer and autumn germinated well, although the early summer percentage was 50 per cent., less than that of spring and autumn.

2. From 1 lb. of seed we obtained about 15,000 seedlings.

3. The seedlings were transplanted after 4 or 5 weeks one and a half foot apart either way. Seedlings can be planted both in spring and autumn.

4. Very little irrigation is needed. In fact too much irrigation or plenty of rain damages the plant.

5. The crop could be multiplied by subdividing the one year or two year old plants and the area as such could easily be multiplied 4 to 6 times.

6. The flowers are ready for harvesting in the beginning of June. The flowers ripen for seed production sometime in the middle of July.

7. In the first year of plantation, very few flower heads are produced second and third year gives increased yields. In the second year we obtained as much as 300lb of flowers per acre and some of the individual bushes did yield 500 flower heads.

8. The flowers were sent for trial purposes to the Malarial Institute of India, which has found the specimen equivalent to the Kenya ones in biological test. It is said to have contained about 1 per cent pyrethrin.

9. The vitality of the seed has not been affected by storage for one complete year so far.

Other cultural experiments including manuring under irrigated and unirrigated conditions in different classes of soils have been started at anout a dozen centres. It is expected that the cultivation of pyrethrum will be started on a very arge scale during the coming season.

The Forest Department had taken up the cultivation earlier and this year they had brought an area of about 200 acres under this crop.

Small samples of five other varieties namely *P. roseum*, P *parihenium*. *P. cineraria*, *P. carneum*. *P. lencopiloides* have also been received from the Imperial Council of Agricultural Research. Out of these only two i. e., *P. roseum* and *P. parthenium* succeeded well. As a plant, none of these can compare well with *P. cinerarioefolium* Samples of flowers are collected and will be sent for biological test. (Pyrethrum cultivation in Kashmir by M. R. Fotidar. *Current Science*, 9: No. 8, August 1940. pp. 360 361) R. R.)

Timber Protection—New Swedish method.

Many attempts have been made to find suitable means of protecting timber against rot and insects Painting is, of course, the most common but, being only a surface preparation, it does not prevent the body of the timber from taking up moisture, and therefore rot gradually appears even in painted wood. The effective components of a new Swedish impregnation method are certain arsenic compounds. The method has been developed by the Boliden Mining Company, in Stockholm, which obtains large quantities of arsenic as a by-product in the smelting of copper ore from its mines in northern Sweden. The impregnation liquid used consists of a solution of various salts, including arsenic. After these salts have entered the timber, a chemical process takes place, with the co-operation of certain easily oxidized substances in the wood itself. The final result of this chemical process is the production of zinc arsenate and chromic arsenate, which become inseparably fixed in the wood, and constitute the effective elements against attacks of decay or insects. Arsenic-impregnated timber is said to retain its mechanical qualities. It takes on a soft green color with a slight shade of brown, which is sufficiently strong to render painting unnecessary if the timber is used in buildings. Another advantage is that the timber does not catch fire as easily and burns less quickly than unimpregnated boards, thus contributing to damage reduction in case of fire. The new method is said to compare very favourably in cost with other methods. In the Scandinavian countries, arsenic-impregnated timber at present is being used increasingly for various kinds of out-door purposes, including quay and other under-water constructions. Twelve impregnation plants in various parts of Sweden are employing the method, in addition to some in Norway and Denmark. (*Sci. Amer*: 163: (1940): 210—211).

Foods—their Value.

Foodstuff.		*Work.*	*Sources.*
1. *Protein.*	(a)	to build and repair all tissues.	Meat, fish, eggs, milk, cheese, cereals, pulses, nuts.
	(b)	to give heat and energy. (of secondary importance as it is an expensive source)	
2. *Carbohydrates.* (starches and sugars)		to give heat and energy.	Sugar, fruit, honey, milk, cereals, pulses, vegetables.
3. *Fat.*	(a)	to give heat and energy.	Cream, butter, fat of meat, milk cheese.
	(b)	to protect delicate organs	Eggs, vegetable oils, cereals, nuts.
4. *Mineral salts.*	(a)	to make bones and teeth.	Milk, green vegetables, fruit, eggs, cheese, fish.

	(b) to keep blood in good condition.	
	(c) to aid growth.	
5. *Water.*	(a) to keep temperature even.	Water, milk, fruit, vegetables, beverages, etc.
	(b) to remove waste matter.	
	(c) to make the body fluids.	
	(d) to dissolve and carry food to all parts.	
6. *Vitamins.*	(a) to help growth.	Vegetables, fruit, liver.
	(b) to maintain health.	Milk, animal fats.
	(c) to prevent or cure certain diseases.	Eggs, cereals, and most common foods, particularly uncooked fruits and salads.
7. *Roughage.*	(a) to prevent constipation.	Fibrous parts of fruit and vegetables, cereals.
	(b) to regulate the bowels.	

N. B.—The sources are placed as much as possible in order of importance.

Kind of diet.	*Result.*
1. Inadequate in quantity, otherwise satisfactory.	Malnutrition.
2. Over adequate.	Obesity and may result in certain diseases developing owing to organs overworking
3. Adequate as regards heat producing substance but deficient in certain essential constituents. (Cheap diet of too much starch).	War or nutritional oedema or certain deficiency diseases from lack of minerals and vitamins.
4. All constituents present but badly balanced.	Too much fat habitually produces kelosis and acidosis Too much calcium upsets absorption of phosphorus.
5. Unsuitable with regard to too little or too much roughage.	Indigestion, constipation or diarrhoea may develop.
6. Food contains poisonous substances through contamination.	Definite poison symptoms.
7. Certain agents lacking.	(a) Determines resistance or response to disease (particularly in children e. g. dental decay, rickets). (b) Pernicious anaemia and numerous other diseases.
8. Diet sometimes satisfactory for ordinary individual, but quite unsuitable for the exception.	Certain people cannot eat straw berries, apricots, etc.
9. Dietary deficiencies,	These link up with endocrine disorders e. g. goitre.

(*The Rhodesia Agricultural Journal*, page 581, Oct. '40.)

Fire Proofing of Thatch.

A. J. Taylor, of the College of Agriculture, Cedara, in the Union Weekly Press Service, gives the following hints for the fire-proofing of thatch:—

One of the drawbacks of thatch in farm buildings is the risk of fire. This danger can be largely eliminated, however, if the thatch is treated before use with a suitable protective material.

Ordinary alum is one of the best and cheapest of such chemicals, whilst ammonium phosphate, sometimes applied as a fertiliser, can also be used.

The bundles of thatch grass should be loosened and then well soaked in a solution of alum, about 4 to 8 ozs. per gallon of water. When thoroughly saturated, they should be removed from the solution and the surplus liquid allowed to drain back into the tank or vessel used for treating the thatch. Standing the loosened bundles on end on a sheet of corrugated iron leading into the tank will ensure good drainage and so save any surplus alum solution. The bundles should then be spread out to dry, standing them on end against a wall or suitable rack so as to ensure a good circulation of air around and through them. It is important that the thatch be thoroughly dry before it is put on the roof. Damp thatching material employed in constructing a roof is very liable to become mouldy and to rot.

The thatch grass should be treated with the alum before it is used. It is less satisfactory to spray a thatch roof already built, since the grass does not become properly impregnated with alum, especially the inner layers to which the solution does not penetrate.

Thatch thus treated will be found to smoulder but not to burn freely. The alum which coats the grass fuses and so forms a protective glaze on the thatch which prevents access of air to the material and so makes it difficult to ignite. Sparks falling on such treated thatch will not set it alight.

The use of alum has a further advantage in that it makes the thatch less liable to harbour insects. [*The Rhodesia Agricultural Journal* p. 607, Oct '40]

Gleanings.

Preservation of vegetables by waxing. It has long been known that a film of natural or artificial wax on the surface of plant tissue is effective in reducing its rate of waterloss and commercial processes have been developed particularly in the citrus industry, which take advantage of this fact. More than 75 per cent of the oranges grown in California and Florida are now being treated in this way. The possibility of extending the process to include vegetables which have to be stored for some time before sale, is now being investigated and useful results are described by H. Plantenius (Cornell Univ. Agric. Expt. stn. N. York, Bull. 723) The method which appears to be the most promising is the dipping process, which can be carried out by hand or mechancial equipment. The vegetables are first washed, and without drying are dipped momentarily into a cold wax emulsion at room temperature and then dried thoroughly, the average thickness of the resulting dry film varying from one to two microns. The chemical nature of these emulsions is very simple. Essentially they consist of colloidal suspensions of one or several kinds of waxes in water, the minute particles being kept in the disperse phase by means of a soap. One of the waxes used contained benzonitres in addition to paraffin and soap. Proprietary articles were used in their experiments, and their names, together with those of their manufacturers and partial compositions, are given. A large variety of veget ables were tested. The result, obtained with topped carrots and cucumbers were outstandingly good, and in general can be recommended for all root crops with the exception of parsnip. The waxing of leafy vegetables is not advised, nor for those which are shipped with ice on top of the container. Waxing does not improve the quality of an inferior product, nor does it prevent the progress of disease but it does reduce shrinking and maintain the fruit or vegetable in a fresh condition for a longer period than would be possible without treatment.

Synthetic Rubber. The newest of the synthetic rubbers, Chemigum, has just been announced by Goodyear as a result of several years' research. A new plant having an initial capacity of 10,000 pounds per day is being installed at Akron. Chemigum is derived from petroleum through a cracking process, and tyres made of it are said to give superior performance to those made of German Buna. In fact, the manufacturer claims that such tyres are equal to those of natural rubber. Like other artificial rubber, however, Chemigum at present costs more than natural crude rubber. Nevertheless, its increased tensile strength; resistance to ageing, abrasion, and oils, and the fact that it may be processed more easily than Buna, make it important industrially. It also has possibilities for blending with natural rubber, so that it might help in an emergency to eke out slender supplies of the natural product. (*Sci. Amer.* 163: (1940) 218-219)

Sulphur dioxide tablets. The National Fruit Research Station in England has perfected a method for the preparation of exact quantities of sulphur dioxide in tablet form. These sulphur dioxide tablets, when dissolved in water, form a solution in which fruit as picked or purchased from shops will keep indefinitely.

The British Ministry of Agriculture, as a war-time measure has appealed to the public to preserve as much fruit as possible. It is stated that the sulphur dioxide tablets are already available and that six pence worth will preserve 20 lb. of fruit. Manufacturers are to use the commercial sulphur dioxide process to preserve surpluses, which will be released as required for jam-making.

Agricultural Jottings.

Early varieties of Ragi and the performance of strain E. C. 3517.

To shorten the duration of a crop with an increase in yield will mean a double benefit to the ryot.

For some years, E. C. 593 has been the departmental strain of ragi which has stood the test, maintaining a high standard of yield, but the strain takes a slightly longer time to mature. In the trials with the early varieties of ragi, the Millets Specialist, has brought out a promising strain, labelled as E. C. 3517. This was tried at the Millets Breeding Station in six series of yield trials both in the early and late season along with strains about 110 days in duration during the past three years. An average increase of about 24% in yield was secured by this strain. In comparing it with E. C. 593, it gave as much yield as E. C. 593 even though E. C. 3517 is ten days earlier in duration. This would mean saving of irrigation charges to that extent. In district trials it has proved superior to local varieties of similar duration in Coimbatore, Karur, Musiri, Kalahasti, Arkonam, Conjeevaram, Chingleput and Saidapet Taluks. The increase in yield in all these cases varied from 11% to as much as 35%.

It must however be borne in mind that evolution of a good strain does not end the problem there. The highest response a good strain gives to the best treatment afforded to it is the test of its popularity. This statement has been amply proved by the performance of this strain on the Central Farm, Coimbatore, during the ragi season this year. Transplanted at the proper time, in a well prepared soil and favoured with irrigations at the proper stages, the crop showed vigorous growth. The ultimate yield from an area of 1·24 acres broke all records for ragi on the Central Farm, giving a rare yield of 4,075 lb. grain per acre. The highest yield obtained so far on the Central Farm was 3,660 lb. of grain from E. C. 593 in 1934–1935 and this year E. C. 593 has raised its own record to 3,734 lb. From the figures recorded outside the Central Farm, 3,882 lb. is the highest figure noticed and this is from Gudiyattam.

E. C. 3517 is a selection from *Mutti Ragi* of Udamalpet taken at the Millets Breeding Station in 1935. The plants are unpigmented and have fist-like earheads. This shape of earhead is liked by the ryots.

(From the Director of Agriculture.)

Provincial Marketing Board. The second meeting of the Provincial Marketing Board was held on the 19th November 1940. The Director of Agriculture (Chairman), the Director of Industries and Commerce, the Registrar of Co-operative Societies, Diwan Bahadur M. Balasundaram Naidu; C. I. E., Rao Sahib G. Rajagopala Pillai, Rao Sahib V. Krishna Menon, Messrs. Vellingiri Gounder, Guduthur Thimmappa, and the Provincial Marketing Officer (Secretary) were present. Mr. T. A. Ramalingam Chettiar attended by special invitation to discuss the present position of the Provincial Marketing Society, Madras.

There were 14 subjects on the agenda. Among the important subjects discussed at the meeting may be mentioned the organization of paddy and rice marketing in the Presidency; the expansion of the oil crushing industry in groundnut; the present position of grading of agricultural commodities and the standardization of weights for rice and paddy in local and export trade. A proposal to publish a co-operative Directory and a proposal to enlarge the weekly price list now published by the Direcor of Industries and Commerce was also discussed. Four subjects were adjourned for the next meeting.

The Board resolved to advise Government that immediate steps be taken to start oil crushing factories in a few important production or market centres with Government assistance, if necessary. It recommended that transactions in rice and paddy marketing should be by weight only and that packages (gunny bags) in the export trade should be standardized. It was suggested that research should be done on the qualitative demand of the various rice consuming centres to ascertain how much demand can be met by adjusting production in adjacent rice producing areas. It was decided to expand grading of commodities under Agmark on a wider front. Grading in the Madras Presidency has now reached a total of over 13½ lakhs of rupees worth of produce handled, the bulk of the produce handled being rice in Nellore and Tanjore Districts and fruits (oranges and mangoes) from Koduru and Chittoor respectively. New grading stations were approved for rice, mangoes, oranges, plantains, grapes, jaggery and hides and skins in other important producing areas. When the Tanjore and Kumbakonam Marketing Societies begin to function, rice grading will be done by them also in addition to grading now in progress by rice grading unions of mill owners in that district. A suggestion to make the grading staff direct employees of the Department was also endorsed by the Board. As regards the work of the Provincial Marketing Society, Madras, the Board came to the conclusion that while it held hopeful signs of advance as a fruit sale society, it was considered that the marketing of other commodities would be best developed through creation of commodity sale societies with subsequent organization in local federations.

The next meeting of the Board will be held in February 1941.

(From the Director of Agriculture).

Crop & Trade Reports

Sugarcane—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory and the yield is expected to be normal in all districts.

The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 9th December 1940 was Rs. 5—2—0 in Erode, Rs. 4—7—0 in Mangalore, Rs. 4—4—0 in Rajahmundry,

Rs. 4—3—0 in cuddalore, Rs. 4—2—0 in Cocanada, and Adoni, Rs. 3—15—0 in Salem and Chittoor, Rs. 3—14—0 in Vizianagaram, Rs. 3—5—0 in Vellore, Rs, 3—4—0 in Trichinopoly, Rs. 2—14—0 in Bellary, Rs. 2—6—0 in Coimbatore. When compared with the prices published in the last report, i. e., those which prevailed on 4th November 1940, these prices reveal a rise of approximately five per cent in Cocanada and a fall of approximately 15 per cent in Vellore, 13 per cent in Mangalore, nine per cent in Cuddalore, eight per cent in Rajahmundry, five per cent in Chittoor, two per cent in Bellary and one per cent in Erode, the prices remaining stationary in Vizianagaram, Adoni, Salem and Coimbatore. [*From the Director of Industries & Commerce.*]

Cotton Raw, in Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 6th December 1940 amounted to 498,728 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939—40. The receipts in the corresponding period of the previous year were 467,345 bales. 5,05,621 bales mainly of pressed cotton were received at spinning mills and 122,786 bales were exported by sea while 135,214 bales were imported by sea mainly from Karachi and Bombay.

(*From the Director of Agriculture*).

Paddy—1940-41 Second Report. The average of the areas under Paddy in the Madras Province during the five years ending 1938—39 has represented 13·2 per cent of the total area under Paddy in India.

The area sown with paddy up to 25th November 1940 is estimated at 8,928,000 acres. When compared with the area of 8,486,000 acres estimated for the corresponding period of the previous year it reveals an increase of 5·2 per cent.

The area is the same as that of last year in Guntur and the Nilgiris. A decrease in area is estimated in Kurnool, Anantapur and Tanjore and an increase in area in the rest of the Province, especially in Vizagapatam (plus 90,000 acres), East Godavari (plus 25,000 acres), West Godavari (plus 65,000 acres), South Arcot (plus 25,000 acres), North Arcot (plus 45,000 acres), Salem (plus 50,000 acres), Trichinopoly (plus 25,000 acres), and Madura (plus 50,000 acres). The increase in area is attributed to timely sowing rains.

The first crop of paddy has been generally harvested throughout the Province. Yields slightly below normal have been reported from Vizagapatam, Chingelput, South Arcot, Chittoor, North Arcot and Tanjore. The yield is expected to be normal in the other districts. The crop has been affected to some extent by the heavy and continuous rains of November 1940 in parts of the Tanjore district and by insect pests in parts of Vizagapatam.

The seasonal factor for the Province as a whole works out to 99 per cent of the average as against 97 per cent in the corresponding period of the previous year.

The wholesale price of paddy, second sort, per imperial maund of 82 2/7 lb. equivalent to 3,200 tolas as reported from important markets on 9th December 1940 was Rs. 3—12—0 in Masulipatam, Rs. 3—9—0 in Ellore, Rs. 3—8—0 in Rajamundry, Bezwada and Guntur, Rs. 3—7—0 in Cocanada, Rs. 3—5—0 in Trichinopoly, Rs. 3—3—0 in Tinnevelly, Rs. 3—2—0 in Vellore and Virudhunagar, Rs. 3—0—0 in Vizianagaram and Chittoor, Rs. 2—14—0 in Hindupur and Kumbakonam, Rs. 3—13—0 in Negapatam, Rs. 2—9—0 in Cuddalore and Mangalore, Rs, 2—5—0 in Anantapur and Rs. 2—1—0 in Conjeevaram. When compared with the prices published in the last report, i. e., those which prevailed on 4th November 1940, the prices reveal a fall of approximately eight per cent in Conjeevaram, and a rise of approximately ten per cent in Nagapatam, eight per cent in

Cuddalore, seven per cent in Masulipatam, six per cent in Ellore and Trichinopoly, four per cent in Bezwada and Chittoor, two per cent in Cocanada, Rajamundry, Guntur, Hindupur and Kumbakonam, the prices remaining stationary in Vizianagaram, Vellore, Virudhunagar and Tinnevelly.

(From the Director of Industries and Commerce).

College News and Notes.

Students' Corner :- Stndents' Club : Under the auspices of the Students' club Sri. N. Krishnaswami Iyengar, B. A., B. L., Sub-judge, Coimbatore, delivered a lecture on "Advise to the students" on 4—12 -40, with Rao Bahadur G. N. Rangaswami Iyengar, Principal in the chair. The lecturer deplored the utter lack of self confidence, the courage of conviction and individuality of judgement that are essential for the development of a dynamic personality. He stressed upon enduring patience and unflinching perseverence for success in life. Plain living and high thinking along with sports-man spirit, should, in the opinion of the lecturer, radiate happiness. Finally the lecturer exhorted the students to develop the immence faculty of intelligence—a speciality of mankind.

Games. On account of the second terminal examinations students' activities have decreased considerably, in both indoor and out-door games.

Hockey. The Bangalore division final hockey match was played at Bangalore against the Ceded districts' College. Our college lost by one goal to nil. The reverse was not due to any superiority of the opponents but unfortunately, due to our players not rising up to their full form. The Vice-President Mr. H. Shiva Rao accompanied the party of players to Bangalore.

Foot-ball. In the inter-tutorial foot-ball match played between Sri. C. R. Srinivasa Iyengar's wards and Sri. C. Narasimha Iyengar's wards, the former won by one goal to nil.

Association of Economic Biologists. A meeting of the association was held on Thursday the 28th November when the following papers were presented:—

1. The probable nature of the clay complex responsible for base exchange phenomena in soils by Sri. C. Raghavendrachar, Assistant in chemistry, and 2. the problem of mixture in the cottons of the Tinnies area by Rao Bahadur V. Ramanatha Ayyar and Sri. V. Ramaswami Mudaliar. This was followed by interesting discussion on the papers.

Two public lectures were also arranged (i) Training in Agriculture by Rao Bahadur Sri. V. Ramanatha Ayyar on 3—12—40 and (ii) Agriculture in Uganda by A. S. Thomas Esq. Economic Botanist, Uganda on the 9th December 1940.

South Indian Branch of the Entomological Society of India. A meeting of the South Indian Branch of the Entomological Society of India was held on Tuesday the 10th December when Sri. T. V. Subramaniam gave an account of his trials with Malarial and Pyrocide 20 larvicide to test their relative merits as mosquito larvicides when used in the irrigation water in paddy fields, especially with regard to their effect on the crop. Sri. P. N. Krishna Ayyar read a paper on 'Host-selection by *Spathius critolans*, Nixon., a braconid parasite of *Pempheres affinis* in S. India in which he detailed the tropic response of the insect to sensory impressions awakened by the host relative to size, shape, etc., and the factors governing the incidence of super-parasitism and the general interactions of host parasite populations. A few interesting insect specimens were also exhibited at the meeting.

Personal. Intimation has been received that Mr. P. H. Rama Reddy, Director of Agriculture who was on leave for six months has rejoined duty at Madras on the 11th December.

Mr. A. R. C. Westlake, I. C. S., who was Director of Agriculture during the absence of Mr. Reddy has been posted as Collector of Coimbatore.

Mr. R. C. Broadfoot, Principal of the Agricultural College, who has been in indifferent health for some months has been granted an extension of leave from December 24, 1940 to 4th Febuary 1942 preparatory to retirement.

Visitors. Dr. A. Subba Rao, Soil Physicist, Dry Farming Station, Hagari was on a short visit to the Research Institute.

Mr. A. S. Thomas, B.Sc., Economic Botanist, Uganda, visited the Agricultural College and research institute.

Mr. R. W. Littlewood, Livestock Development Officer, Madras, stayed on the College estate from 11th to 17th December.

A party of students and staff of the Board High School, Bhavani, the Govt. Training School, Coimbatore, and the Govt. Training School for Women, Palghat, visited th: College and Research Institute and Central Farm.

OBITUARY

We record with deep regret the death of Sri. V. Panduranga Rao, Assistant in Plant Physiology, in the Bellary Dry Farming Scheme, on November 28, 1940.

Sri. V. Panduranga Rao was an M. A. of the Madras University and joined service in this Department as an Assistant to the Millets Specialist in 1926. In 1935 he was appointed as Assitant in Plant Physiology and posted to Hagari to work in the Dry Farming Scheme. He was deputed to America (Nebraska) to study plant physiology under Dr. J. E. Weaver. He stayed in America for about 14 months where he acquitted himself very creditably. During his stay he obtained the M. Sc. degree and was elected to the Honorary Scientific Society of Sigma XI as an active member. He returned in 1937 and plunged into his work, specialising in root studies and control of soil erosion, till the time of his death at the age of 36. His researches were of a high order. He endeared himself to one and all of his colleagues and acquaintances by his genial manners. He leaves behind him his young wife and 3 children, his aged father who is a retired Assistant Secretary to the Board of Revenue, Madras and numerous relations and friends to mourn his untimely death.

Weather Review—NOVEMBER 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·2	−3·8	72·1
	Calingapatam	0·1	−3·8	45·9
	Vizagapatam	1·9	−1·9	33·9
	Anakapalli*	1·1	−2·9	40·7
	Samalkota*			
	Maruteru*	3·7	−0·1	40·6
	Cocanada	6·3	+0·9	46·0
	Masulipatam	7·3	+1·6	41·0
	Guntur*	3·3	+0·2	33·2
Ceded Dists.	Kurnool	0·2	−0·9	29·1
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·9	−0·4	21·9
	Siruguppa*	1·2	−0·3	24·4
	Bellary	0·6	−1·6	22·0
	Anantapur	3·1	+0·3	27·3
	Rentachintala	2·4	..	26·7
	Cuddapah	6·1	+2·5	39·9
	Anantharajupet*	23·7	+14·4	49·5
Carnatic	Nellore	26·5	+15·3	53·6
	Madras	22·5	+8·2	46·6
	Palur*	36·7	+24·0	59·5
	Tindivanam*	19·2	+8·7	43·8
	Cuddalore	42·3	+27·2	69·5
Central	Vellore	10·6	+3·6	35·8
	Salem	3·2	−0·5	39·3
	Coimbatore	13·3	+9·5	37·6
	Coimbatore A.C. & R.I.*	12·8	+8·0	30·5
	Trichinopoly	11·6	+6·0	34·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	43·1	+25·4	58·2
	Aduthurai*	21·5	+10·6	44·7
	Madura	14·0	+9·0	42·7
	Pamban	23·1	+11·1	44·3
	Koilpatti*			
	Palamkottah	10·9	+3·5	25·8
West Coast	Trivandrum	7·7	0·0	66·6
	Cochin	10·2	+3·7	129·4
	Calicut	7·5	+2·1	128·8
	Pattambi*	6·1	+2·0	98·0
	Taliparamba*	0·0	0·0	0·0
	Kasargode*	11·1	+7·7	151·8
	Nileshwar*	6·1	+2·8	156·7
	Mangalore	8·1	+5·0	149·7
Mysore and Coorg	Chitaldrug	1·6	−0·7	33·9
	Bangalore	6·4	+3·5	35·9
	Mysore	13·0	+10·4	47·5
	Mercara	7·7	+4·5	142·4
Hills	Kodaikanal	23·3	+15·1	71·8
	Coonoor			
	Ootacamund*	12·7	+1·3	52·5
	Nanjanad*	11·1	+7·1	51·5

The weather over the Presidency was characterised by a great activity of the seasonal trough of low pressure over the south of the Bay, which was active throughout the month and occasioned almost continuous rains over the south east of the peninsula.

The month opened with unsettled weather in the south west of the Bay in the neighbourhood of Ceylon which moved into the south east Arabian sea and developed into a depression by the 3rd and into a storm on the 4th but weakened by the 6th and passed away by the 7th. On the 7th weather was again markedly unsettled to the west of Ceylon but the unsettled conditions disappeared by the 9th. Again on the 11th weather became unsettled in the south west of the Bay and developing into a depression and crossed inland and lay near Salem on the 12th morning, moved into the Arabian sea the next day, and intensifying into a storm on the 14th, weakened off the Kanara coast by the 15th.

On the 15th unsettled condition in the south of the Bay developed into a depression centred near latitude 13°N and Long 85°E and moving in a north easterly direction as a storm lay centred at Lat. 19°N and 89°E by the 18th but

became unimportant by the 19th morning when a fresh depression formed in the Central Bay of Bengal and weakened and filled up off the Coromandel coast by the 24th. On the 27th conditions were unsettled in the North East and East Arabian sea but passed off by the 27th. Weather in the south of the peninsula was more settled from then till the end of the month. The almost continuous unsettled weather associated with the activity of the trough of low pressure and resulting in the formation and passage of depressions across the south of the peninsula, and in the Bay, occasioned very heavy rainfall in the south east of the peninsula.

Rainfall over the Presidency was in very large excess in the Carnatic, Central and Southern districts and in the adjoining areas in the Ceded districts and in Mysore, Coorg and Malabar being in some cases over 400% of the average rainfall. Rainfall was in large defect in the northern districts of the Circars, and in slight defect in the Ceded districts in the western parts.

The chief falls of rain reported were:

Nagapatam ...	10·4″ (6th)
Nellore ...	6·4″ (13th).
Pamban ...	5·4″ (18th).
Madras ...	5·1″ (12th).
Cuddalore ...	4·9″ (2nd).
Vellore ...	4·3″ (12th).
Coimbatore A. C. R. I. ...	4·46″ (3rd).
Cochin ...	3·7″ (14th).
Mysore ...	3·7″ (24th).
Masulipatam ...	3·6″ (10th).

Weather Report for the Agricultural College and Research Institute Observatory

Report No. 11/40.

Absolute maximum in shade ...	88·8°F
Absolute minimum in shade ...	66·3°F
Mean maximum in shade ...	83·1°F
Departure from normal ...	−1·4°F
Mean minimum in shade ...	70·5°F
Departure from normal ...	+2·0°F
Total rainfall for the month ...	12·77 inches.
Departure from normal ...	+7·97 ,,
Heaviest fall in 24 hours ...	4·46 ,,
Total number of rainy days ...	11
Mean daily wind velocity ...	1·1 m. p. h
Departure from normal ...	−1·13 ,,
Mean humidity at 8 hours ...	88·2%
Departure from normal ...	+7·6%

Summary: The weather during the month was characterised by almost continuous rain, due to the disturbances originating in the Bay of Bengal. The rainfall was in very large excess, being 12·77 inches or 7·97 inches above the average. The heaviest fall in 24 hours was 4·46″ recorded on the 3rd which constitutes a record for over 18 years of rainfall records at the institute.

Skies were in general heavily clouded and humidity in excess. Day temperatures were below normal and night temperetures above normal. Air movement was generally below normal.

P. V. R. & R. S.

Departmental Notifications.

Gazette Notification.

Appointment.

Sri. M. Sanyasi Raju, Assistant in Bacteriology section, Coimbatore is appointed to officiate as Agricultural Bacteriologist, Coimbatore in category 7 class I Madras Agricultural service with effect from 3rd January 1941 vice Mr. P. D. Karunakar granted leave.

Sri. T. V. Subrahmanya Ayyar, Assistant Entomologist, Coimbatore, will be in charge of the duties of Government Entomologist, in addition to his own during the absence of Mr. M. C. Cherian on leave for 9 days from 3rd January 1941 with permission to prefix Christmas and New year holidays and suffix the holidays from 12th to 14th January 1941.

Sri. L. Narasimha Acharya, Agricultural Demonstrator, Chittoor, is appointed to officiate as Assistant Director of Agriculture, in category 6—class I Madras Agricultural service and is posted to Cuddalore.

Sri. V. N. Subbanna Acharya, Agricultural Demonstrator, Rayadrug is appointed to officiate as Assistant Director of Agriculture in category 6, class I, Madras Agricultural service and is posted to Cuddapah.

Transfers.

Name of officers.	From	To
Sri. K. Raghava Acharya,	Asst. D. A., Cuddapah	Asst. D. A., Madura.

Leave.

Name of officers.	period of leave.
Sri. M. U. Vellodi, Asst. D. A., Tellicherry,	L. a. p. for 3 moths from the date of relief
„ M. Anandan, Asst. D. A. Cuddalore,	L. a. p. for 28 days from the 26—11—40
„ Samuel Jobitha Raj, offg. Asst. D. A., Madura,	L. a. p. for 4 months from the date of relief.
„ P. D. Karunakar, Agricultural Bacteriolgist, Coimbatore.	L. a. p. for 1 month from 3—1—41.
Mr. R. C. Broadfoot, Principal, Agricultural College, Coimbatore.	Extension of leave from December 24, 1940 to February 4, 1942, preparatory to retirement.

Subordinate Services.

Transfers.

Name of officers.	From	To
Sri. I. Kurma Rao,	A. D., Repalli,	Special duty in the Vuyyuru Factory area.
„ G. L. Narasimha Rao, A. D.,	A. D., Special duty, Vuyyuru Factory area.	A. D., Repalli.
„ A. R. Krishnamurthy,	A. D., Madura	A. D., Karur.
„ V. K. Appaji	A. D., Karur,	Special duty Sugarcane work Pugalur.
„ V. Ratnaji Rao,	A. D., (on leave)	F. M., Kalahasti.
" N. V. Kalyanasundarm,	F. M., Kalahasti,	A. D., Kalahasti.

„ E. K. Govindan Nambiar	F. M., (on leave)	F. M., Taliparamba.
„ P. A. Narayanan Nambiar,	F. M., Taliparamba	A. D., Krishnagiri.
„ N. Srinivasa Rao,	A. D., Krishnagiri	A. D. Salem.
„ N. S. Rajagopal Iyer	A. D., Salem	A. D. Rasipuram.

Leave.

Name of officers.	Period of leave.
Sri. J. Suryanarayana, A. D., Gurzala.	Extension of l. a. p. on m. c. for 1 month and 5 days from 19—11—40.
„ B. N. Padmanabha Ayyar, A. D., Gingee.	Extension of l. a. p. on m. c. for 2 months from 1—12—40.
„ C. S. Namasivayam Pillai, A. A. D., Nanguneri.	Extension of l. a. p. for 2 months with m. c. from 19—11—40.
„ M. S. Kylasam, Asst. in Entomology Coimbatore.	L. a. p. for 28 days from 26—11—40.
„ E. Achuthan Nayar, Asst. A. D., Harur.	L. a. p. on m. c. for 4 months from 19—11—40.

Notice.

Members, and subscribers, whose subscription expires by 31st December 1940, are kindly requested to remit their subscription before the end of January. The M O. form with particulars filled in is enclosed for their convenience.

K. Ramaswami,
Manager.